THE

ELECTRICAL REVIEW.

VOL. XCI. DECEMBER 15, 1922. No. 2,351.

ELECTRICAL REVIEW.

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	Page
The National Joint Board...	889
Electric Traction between the North Sea and the Mediterranean	890
Electricity in Agriculture...	890
South African Industries...	891
The Russian Electrical Industry...	891
The German Electrical Industry...	891
Hydro-electric Development in Tasmania, by Fred. A. Talbot (*concluded*)	892
Electricity Supply Problems, by W. S. Kennedy	893
Sales; the Deciding Factor, by J. E. Chamberlain	893
New Electrical Proposals for Parliament to Consider ...	894
Legal...	894
Correspondence—	
Estimating for Internal Wiring Contracts	895
The Hastings Electricity Undertaking	895
Electric Power for Pulverising	895
The Prospects for Young Engineers Abroad	895
A Metering Problem	896
Improvement of Power Factor	896
The "Standard" Brush-holder	896
Electricity in Agriculture	897
The Trade Possibilities of the British Empire	897
The Institution of Electrical Engineers...	897
Russia's First Regional Power Station	898
Business Notes	899
The Association of Consulting Engineers and its Chairman (*illus.*)	905
The Liverpool Electricity and Tramway Undertakings (*illus.*)	906
Notes...	910
City Notes	913
Stocks and Shares	915
Market Quotations	916
The Possibilities of Underground Transmission at 100/150 kV, by A. M. Taylor (*illus.*)...	917
North-East Midlands Electricity District	919
High-power Thermionic Valves (*illus.*)...	921
Parliamentary Notes	922
New Electrical Devices, Fittings, and Plant (*illus.*)	923
New Patents	924
Published Specifications	924
Contractors' Column ... ... Advertisement page	xxx

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THE NATIONAL JOINT BOARD.

THE negotiations between the electricity supply authorities and their technical staffs regarding the new proposals that have been put forward by the former have come to an abrupt termination, the employers' side having withdrawn from the Board *en bloc*. This proceeding, we fear, will have a seriously detrimental effect upon the Whitley system, which has hitherto worked so well in the electricity supply industry.

From the secretary of the Board we learn that the following resolution of the employers' side was handed to the representatives of the Electrical Power Engineers' Association, who constitute the employés' side:—

> Having examined the agreements entered into by the E.P.E.A. with the Municipal Employés' Association and with the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motor-men and Electrical Workers, the Employers are of opinion that:—
>
> (1) The agreements which the E.P.E.A. have made with the Municipal Employés' Association and with the National Amalgamated Union of Enginemen, &c., are not in keeping with the arrangement of having a National Board and a National Joint Council whereby negotiations and agreements with the executive staff are kept separate and apart from negotiations and agreements with the manual staff.
> (2) These agreements between the E.P.E.A. and the Unions representing the manual staff are subversive of discipline.
>
> The employers have, therefore, resolved that they will not continue to form part of the National Joint Board unless these agreements are terminated.

The agreements in question were published in the *Electrical Power Engineer* for September, and we commented upon them at the time as constituting valuable safeguards against the wanton and ill-considered attempts to shut down public electricity supply with which the industry has been threatened in recent years, often arising out of matters wholly alien to the supply industry. The employers, it will be seen, took a different view; they declared that unless the Association cancelled them, they would withdraw. The Association, of course, declined to do this, and negotiations were broken off.

Had the Association agreed to comply with the employers' terms, it would have ceased to command the respect of honourable men; and that would have been its ruin. Regardless of the terms of the agreements, we are of opinion that to have denounced them at the bidding of the other party on the Joint Board would have been equivalent to walking under the yoke in Roman times. The employers' side was ill-advised in putting forward so impossible a proposal; it did not place the Association on the horns of a dilemma—it left the representatives of the latter no option. Much as we regret the occurrence, we are bound to express our approval of the decision that they made.

This, we repeat, is without regard to the terms of the agreements; whether the latter were good or bad, wise or foolish, mattered not a jot when freedom and honour were concerned. But we have already given reasons for our belief that the agreements would—and will—bear good fruit; they will tend to preserve peace in the electricity supply industry, and we believe that they were conceived to that end.

Our approval was based upon the fact that they were "in essence, law-abiding"; their whole tendency was to discourage irresponsible strikes and to ensure that in no case should any drastic action be taken without

the most careful consideration. The policy of the E.P.E.A., as we understand it, is directly opposed to strikes, above all to strikes about matters arising outside the industry; on the other hand, all questions which rightly concern the industry necessarily fall within the scope of the National Joint Council or the National Joint Board, and come before them for consideration. As we pointed out (p. 543), the parties to the agreements are "virtually pledged to observe the decisions of the Whitley Councils," and in fact they hold the only weapon for enforcing those decisions, with which the employers' side is of course in agreement. At least one case has occurred in which the employers' side of a District Joint Board has felt it necessary to entrust the issue to the hands of the trade-union side.

We understand that the chief bone of contention is Clause 5, which deals with disputes that do not come within this category; it is obviously conceivable that, however averse the E.P.E.A. might be to a strike on such a matter, its representatives on the "Joint Conference of Executives" of the trade unions concerned might be outvoted and the Association might thus be forced into joint action. As the E.P.E.A. executive cannot, we believe, under the constitution of the Association, take strike action without balloting the members, this seems a very remote contingency. But if this clause were the only stumbling block, presumably it could be modified. It is one thing to issue an ultimatum, but quite another matter to negotiate; and we venture to suggest that if a modification of this clause would satisfy the employers' side, the Association might well consider the matter in that light. The all-important need is to bring the parties together again in friendly discussion across the table—no good end can be served by cutting off communications.

The Association has retained its self-respect and the respect of the trade unions, and will undoubtedly gain increased strength from the incident. But the Whitley system has received a shrewd blow from those who should have been its best friends—for it affords the best means of maintaining peace and continuity of supply.

ELECTRIC TRACTION BETWEEN THE NORTH SEA AND THE MEDITERRANEAN.

THE many attempts made by German electrical interests prior to 1914 to induce successive "governments" seriously to consider the question of converting main lines of railway to electric traction were always frustrated by the military authorities, owing to the belief that in the event of war it would easily be possible for an enemy to destroy a vital power station and thus disorganise the military traffic on the railways, which for that matter were always designed for strategic purposes. Since the revolution, and consequently the overthrow of the military party, provisionally at all events, more attention has been paid in Government circles to the problem of the adoption of electric locomotion on the railways, although the progress made in this direction in recent years has been comparatively insignificant. But a new reason has arisen in favour of the promotion of the modern method of railway traction—one which did not exist before 1914. We refer to the comparative scarcity of pit coal in Germany consequent upon the transfer to Poland of a large portion of the coal-mining fields in Upper Silesia, the loss of the production of coal in Lorraine, the elimination from German control of the output of the region of the Saar for a definite period of 15 years from the date of the coming into force of the Treaty of Versailles, and the compulsory deliveries of coal which have to be made by Germany on account of indemnity.

The German railways, now united in a Federal system, consume several millions of tons of pit coal per annum, or about one-tenth of the total consumption throughout the country. As, for the reasons already stated, the scarcity of coal has become acute, and is only relieved to some extent by imports at the present rate of millions of tons annually, any scheme which would tend to facilitate matters is likely to receive due consideration. In this connection Dr. Grooner, Minister of Railways, is reported to have conceived a scheme for the electrification of all the important lines in the national network. The project is based upon the establishment of steam generating stations using lignite as fuel in the north and centre of Germany, situated on the site of the lignite deposits, while in the south the power would be supplied by hydro-electric works proposed in connection with the Rhine, the Main, the Neckar, and the Danube. Although these schemes do not appear to be entirely new, the Minister of Railways hopes, as a result of their realisation, to be able in the course of time to reduce the imports of coal, which are mainly from England and are largely used for locomotive purposes, to minimum proportions, and after the expiration of the period of compulsory deliveries of coal to the Allies, to be able to render the country entirely independent of coal imports from other countries. In the meantime it may be mentioned that the Minister recently made an inspection of the electrical working of the St. Gothard Railway, and the impression which was gained was so favourable that he is reported to have decided without delay to proceed with the electrification of certain main lines, including those between Basle and Frankfort-on-Main, Carlsruhe, and Stuttgart, and then to extend the work to Berlin and Hamburg.

With regard to further developments of European railway working, a Berne (Switzerland) correspondent states that in the year 1924-25 the cities of Geneva, Lausanne, Zurich, and Lucerne will be connected by means of electric railways, and also with Basle. A little later the connection may be extended to Frankfort, Berlin, and Hamburg, which would represent an extraordinary development of the Swiss-German railway communications. A still further expansion is foreseen by an Italian newspaper, which mentions that electric trains will be inaugurated between Chiasso and Basle in 1924, and subsequently between Chiasso and the North Sea. In the case of Italy, it is stated that the electrification of the line between Genoa and Milan is being actively pushed forward, and that work will be completed in from two to three years. As to the question of the dispatch of trains from the port of Genoa through the St. Gothard tunnel, and thence to Hamburg, *via* Frankfort, it is pointed out that no technical difficulties stand in the way of the realisation of the scheme, and that it would have been possible—on the assumption that the previously-referred-to German proposals were carried out—if the Italian Government had not omitted from its programme a section of 25 miles represented by the trunk line, Milan-Chiasso. This missing link, the reasons for the exclusion of which are unknown, just interrupts—or will interrupt—the continuity of electric traction between Switzerland and the Italian network—between the St. Gothard railway and the port of Genoa. It is considered that as Switzerland is proceeding to extend the electric railway system and that as financial reasons are not responsible for the gap existing between Milan and Chiasso, a good understanding between the two countries might result in overcoming whatever difficulties now oppose the construction of this connecting link.

Electricity in Agriculture.

A CORRESPONDENT draws attention to the fact that in the course of a debate in the House of Comomns on the revival of agriculture, no reference was made to the subject of electricity. Unfortunately the average member of Parliament has little opp rtunity of making himself acquainted with technical p ogress,

and the daily Press, which ought to educate him in that respect, is too busy recording the sordid details of murders and divorces to devote attention to such matters. There are, however, a few engineers in Parliament, and whilst we deprecate the view that any member should regard himself as the representative of any special interest other than the welfare of the whole community, we feel that it is their duty as engineers to impart information on engineering subjects to their fellow-members. So will they most efficiently serve the State.

And the application of electricity to agriculture is most certainly an engineering problem. No one can read the illuminating articles which Mr. R. Borlase Matthews is contributing to our pages without realising that the use of electricity on the farm does not imply the mere installation of wiring and motors on ordinary workshop lines; the special conditions and requirements must be studied, and new methods must be devised to comply with them. In this respect we in this country are far behind the Continent, where the application of electricity to agriculture has attained an extraordinary degree of development.

The fault does not lie with the farmer; the experience of Mr. W. T. Kerr at Hereford, and Mr. Bexon at Kilmarnock, proves that when the farmer is given the opportunity to use electricity he takes advantage of it. Nor does it lie wholly with the supply station engineer, for up to the passing of the Act of 1919 his operations were more or less restricted to a limited area, and he could not extend his mains into the surrounding country without entering upon a cumbersome procedure; moreover, he had first to convince his committee or directors that such extension was not of so speculative a character as might appear; that the number of consumers per mile would be sufficient to justify the capital outlay, and that the load was of a desirable nature. All these and other points will be greatly elucidated by the scientific investigations which are being carried out on his own farm by Mr. Matthews, and which he so ably interprets for the benefit of our readers; his profession of engineer-farmer is at present unique, but we hope that his example will encourage others to assist in infusing new life into that most ancient industry which he has apparently undertaken to rejuvenate.

There is one point in Mr. Richardson's letter calling for a personal comment, where he says: "It is welcome indeed that the technical Press are now taking the matter up." For the past 20 years the application of electricity to agriculture has constantly received attention in the columns of the Electrical Review; our faith in its future has never wavered, and in suggesting that we are "now" taking the matter up, our correspondent, of course unintentionally, does us an injustice.

We are pleased to note that the Government is to set up a Committee of Investigation to inquire into the agricultural methods adopted in other countries, and we hope that the opportunity will be taken to state the case for electricity as fully as possible.

South African Industries.

July, 1922, was as far as H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham) brought the information contained in his report on economic conditions in the Union, which was recently issued by the Department of Overseas Trade, and was abstracted in our last issue. It would therefore seem that some delay has taken place in its publication, and this is a matter for regret; these delays should be avoided. The report does not convey the same hopeful impression of the prospects of a revival of British trade as the report by the representative of the Federation of British Industries, which was recently summarised in these columns. Doubtless this is due partly to the guarded view that the official is constrained to take, and, to some extent, to the fact that the signs of revival in South African trade have been more distinct during the last two or three months than during the first half of the year. Railway electrification and telegraph and telephone extension should provide much work for United Kingdom factories in the not far distant future. British industry has already made a good start in competing successfully for the railway work, but, according to a recent message through Reuter, is apparently behindhand in obtaining orders for the automatic telephone installations which are being adopted. Mr. Wickham deals in an out-spoken manner with the Union's attempts at industrialisation, which have apparently not yet gone far in the direction of quality production. He says that the engineering industry proper is still exceedingly small, being mainly assembly and repair work, although good and ambitious efforts are being made here and there.

The Russian Electrical Industry.

The managers of the Russian electrical industry comprised in the Glavelectro Trust have decided to establish a representation in Berlin to supervise the execution of orders placed in Germany in connection with the electrification of Russia. The representation will also accept delivery of the orders and serve as an organisation for the conveyance of information for the Russian and German electrical industries, and will work under the control of the Foreign Trade Commissariat.

Mr. P. E. Brusewitz, who has just returned to Stockholm from a journey in Russia, is reported to have stated that orders received by one Swedish firm for hydraulic turbines would certainly be followed by other and similar orders for hydro-electric works in Russia. There is also a demand for Diesel engines, electric lamps, &c.

Several Reuter trade dispatches regarding Russian affairs have lately come to hand. One from Berlin quotes a director of Krupps as believing that the agreement reached between Krupps and M. Stomaniakoff, the commercial representative of the Soviet Government in Berlin, would be ratified by the Soviet Government. Krupps, it is stated, were enabled to take up the concession because the participation of certain British groups had been secured to the extent of 75 per cent. of the capital in sterling.

Another dispatch refers to the steady progress that is being made, in spite of all difficulties, with the Russian electrification plans drawn up by the Eighth Congress of Soviets in 1920. It is reported from Moscow that seven electricity stations are at present being constructed —one hydro-electric, three utilising peat, and three coal. The most powerful station is the 80,000-kW hydro-electric station at Volkhov, near Petrograd, which is to be finished in 1925. Stations are already partially working at Utkina Zavod (4,000 kW), Shatura (50,000 kW), and the Kashira (12,000 kW). Further construction on these stations is proceeding. Electricity works of great importance are being built at Nijni Novgorod, Kizelov in the Urals, and at Shtaro in the Donetz Basin.

Some interesting information respecting the Kashira undertaking appears elsewhere in this issue. One of the principal features of the scheme is a 115,000-V transmission line 80 miles in length mounted temporarily on wooden poles of very simple construction. Low-grade brown coal is used for fuel.

The German Electrical Industry.

The Government survey of the November reports of the Prussian Chambers of Commerce records a continuance of the "bad business situation" for electrical manufacturers, as under existing conditions prices have to be quoted according to a sliding scale. The uncertainty as to what the prices will eventually be has produced great reserve in the allocation of orders, and those for machines, switchgear, and meters have further decreased.

HYDRO-ELECTRIC DEVELOPMENT IN TASMANIA.

By FRED. A. TALBOT.

(*Concluded from page* 858).

Steel towers are used throughout upon this main transmission line. They are of angle iron, 65 ft. in height, and spaced at an average distance of 600 ft., with strain towers approximately two miles apart and at each angle of the lines. The most notable features of the trunk transmission are the crossings of the Derwent River at Bridgewater and Risdon, the last-named being only a few miles from Hobart. The Bridgewater crossing has a span of 1,010 ft., with a minimum clearance of 100 ft. between high water and the lowest sag. To meet the situation, special towers and conductors had to be introduced, the conductors being silicon bronze cable. At Risdon the conditions were somewhat more exacting. Inter-state shipping frequently passes this point, and, accordingly, to meet the requirements of navigation, a clearance of 150 ft. between high water and lowest sag had to be provided. The span is also somewhat more imposing, being 1,850 ft. Special towers and conductors had to be designed to complete the crossing, the conductors in this instance being copper-clad steel. The transmission throughout is protected against lightning by a 7/12 steel cable carried over the tops of the towers.

A single-circuit 88,000-volt line branches from the trunk at New Town, near Hobart, for Electrona. This line is 14 miles in length, and is of 3/.097 bare copper conductors carried on wooden towers of "A"-frame construction, though the insulators are similar to those used on the main line. Another single 88,000-volt line runs from the Waddamana power-house to Launceston, a distance of 52 miles. This line is similar to the 10,000-h.p. circuits running from the power-house to Hobart.

The receiving station at Hobart occupies a site adjacent to the Electrolytic Zinc Co.'s premises three or four miles from the capital. This sub-station is designed for an output of 68,000 h.p., of which 38,000 h.p. has been installed. It is at present equipped with two banks of single-phase transformers stepping down from 88,000 to 11,400 volts. Each bank is of 15,000 kVA capacity, and this installation is notable for being the largest transformer set yet erected in Australia. There are also two transformer banks of 4,000 kVA capacity per bank, stepping down from 88,000 to 6,600 volts. Transformers, 88,000-volt lightning arresters, oil circuit breakers, disconnecting switches, and bus-bars are all of the outdoor type, and, with the special steel structures for supporting the incoming lines, busses and switches, occupy a space measuring 240 ft. square. Adjacent to the outdoor installation is a brick building, 112 ft. long by 50 ft. wide, housing the 11,000 and 6,000-volt switchgear, meter equipment, and auxiliaries, as well as providing accommodation for stores and a workshop. All main 88,000-, 11,000-, and 6,600-volt main switches are electrically operated from a control board in the building. The equipment also includes a storage battery of 300 ampere-hour capacity (10-hour rate) for operating the oil switches and for emergency lighting.

The power demanded by the Electrolytic Zinc Co. is led to the sub-station of the latter, a distance of 500 yards, through 11,000-volt, three-core underground cables. Power for the Hobart distribution network is furnished through two overhead 3-phase feeders comprising 19/12 copper cable. These run direct to the tramway sub-station, from which point the reticulation feeders radiate. The northern suburbs of Glenorchy and Claremont are supplied through overhead copper feeders, the Cadbury, Fry & Pascall factory at the last-named suburb being an important consumer.

At the tramway station, transformers and rotary converters convert the 6,600-volt, three-phase current to 550-volt d.c. for use on the tramway system, and to 500-volt d.c. for private power consumers. The rotary converters are regulating pole machines, and the switching arrangements installed are of such design that any machine can supply current at either of the pressures mentioned for tramway or general power purposes.

The bulk supply at 88,000 volts to Electrona is stepped down through a bank of 4,000-kVA transformers to 6,600 volts, the transformers, together with the oil circuit breakers and lightning arresters, being placed out of doors. The switchgear controlling the 6,600-volt side and the metering equipment are installed in an adjacent building. Energy is supplied at 6,600 volts over bare copper conductors supported on a wood pole line with pin-type insulators to the carbide works for the operation of the electric furnaces.

The energy transmitted at 88,000 volts is received at the sub-station on a site adjacent to the Launceston municipal power-house. It carries a bank of 4,000-kVA, 88,000/6,600-volt step-down transformers which, with all equipment, is housed in a steel-frame building. A short overhead feeder line carries the power at the reduced voltage from the sub-station to the municipal power-house.

All the large power transformers installed at the various stations are water cooled. With the exception of the plant at Hobart, fresh water is used for this purpose; those at Hobart are cooled with salt water pumped from the harbour through a pipe-line approximately a quarter of a mile in length.

As already mentioned, although the Great Lake project is capable of furnishing about 250,000 h.p., it is probable that only one half will be exploited commercially—about 127,000 h.p. There are four subsidiary projects capable of development and embraced in this scheme. These are respectively:—

Upper Shannon	13,000 h.p.
Lower Ouse, No. 1	40,000 ,,
Lower Ouse, No. 2	8,000 ,,
Lower Ouse, No. 3	8,000 ,,
Total	69,000 h.p.

which, added to the 58,000 h.p. already being developed, gives the aggregate of 127,000 h.p. mentioned.

Although the Great Lake scheme may be said to constitute the basis of the comprehensive hydro-electric power programme which has been embraced, there are several other potential hydraulic fields capable of development. The preliminary surveys of these projects have been carried out, and the tentative designs for their exploitation are now under consideration. These comprise the following:—

Huon River	20,000 h.p.
Florentine River	40,000 ,,
Upper Derwent	40,000 ,,
Arthur's Lakes	16,000 ,,
Lake Rolleston	25,000 ,,
King River	60,000 ,,
Sundry smaller schemes ...	22,000 ,,
Total	223,000 ,,

These schemes, added to the Great Lake project, bring the total possible hydro-electric generating facilities to 350,000 h.p.

A considerable amount of exploration work in connection with foundations has already been done. Furthermore, in anticipation of future developments, river gauging stations are being established on every

important river. The investigatory work concerning the potential hydro-electric yield forthcoming from all the waters of the Island State is being actively pursued. Power surveys have been made over the greater part of the island, but there are several important rivers on the west coast which still remain to be explored in this connection. The survey of this untouched field is to be put in hand forthwith, and it is anticipated that field work will reveal the existence of at least 150,000 h.p. over and above what has already been definitely ascertained.

It is obvious from what has been related that hydro-electric development in the Island of Tasmania, now that it has been successfully launched, is to be pursued energetically, so that the department may be efficiently and completely equipped with data essential to any rapid development of available resources in accordance with commercial expansion. Once the full advantages accruing from the utilisation of electricity are appreciated for power and lighting, as well as heating, for industry, agriculture, commerce, and domestic purposes, rapid expansion may safely be anticipated, and should be productive of results as far-reaching as have been recorded in Canada and California.

ELECTRICITY SUPPLY PROBLEMS.

The Legal Position.

By W. S. KENNEDY.

The following problem was recently raised by a correspondent of the Electrical Review:—"An industrial company A taking a small amount of power and lighting—chiefly for stand-by and week-end purposes—from a municipal electricity supply authority, is desirous of extending its wires for the purpose of driving at the week-ends a small motor belonging to another industrial concern B adjacent to its own property. This small service can be quite easily given by the customer A as only a few yards of cable are required, but if the supply authority itself gives the supply it will mean a fairly expensive outlay in service cables, on which the prospective customer B would no doubt be called upon to pay a fairly heavy annual rental.

"Is there any regulation or legal objection to such a scheme being carried out? It is considered that the supply authority itself would not object, inasmuch as it is its electricity which is to be used, although the whole of the supply goes through the meters of A, and B (who really is a customer) is not on the books of the supply authority at all."

There seems to be no legal objection to the adoption of the course suggested by A if certain conditions are observed. The most obvious is that the supply authority would probably require A to become responsible for all payments; and, indeed, since B would not be a consumer, it could look only to A in that connection. If A's supply is charged for on a maximum demand system, the rate would probably have to be adjusted with the supply authority to meet the altered circumstances. It is assumed that the connecting cables from A to B are entirely on private property. If not, arrangements must, of course, be made with the local authority in case any underground work is required, and any existing regulations as to overhead lines must be complied with. Such a supply would probably not come under Section 23 of the Act of 1909, which prohibits unauthorised undertakers from competing with statutory authorities, but even if it could be held so to do, the present case would be covered by the proviso to that section, since the business of A (the person affording the supply) is not "primarily that of the supply of electrical energy to consumers."

Under the Clauses Act, 1899, the consumer must inform the supplying authority of the maximum power which he requires, and the authority is entitled to be satisfied that the internal fittings and apparatus on the premises to be supplied are in good order. This would apply to fittings, apparatus, &c., on the premises of B. Apart from these points, which should be capable of adjustment, no objection apparently exists to the course proposed, which seems to the advantage of all parties concerned.

The question leads to the consideration of another and cognate point which many correspondents have raised; that is, the charges made by a supply authority for that portion of the service main which goes over the consumer's premises and for "connecting supply" generally. This is purely a business question—the legal right of the supplying authorities to make such charges is, save in rare events, indisputable under the Clauses Act, Schedule, Sec. 27. Whether such charges pay the authority supplying in the end is more than doubtful. The thing which, apart from its general desirability, will in the long run profit supplying authorities is the widest possible use of electricity, and this can only be arrived at by making the supply as cheap as possible. In the case of small consumers, the heavy charges for connection now made by certain electricity supply authorities must outweigh even a low price per kWh and choke off many would-be users of electricity. It is not suggested that a supply should be given at a loss, but in order to make the use of electricity general—an end which becomes more and more desirable—the price must be cut to the lowest limit and the supply made in every way as accessible as possible. From the business point of view, it may be that the form in which the charge for connection is made deters would-be consumers as much as the actual amount, but this is a psychological question with which the author is hardly competent to deal. It is, nevertheless, worth considering whether an authority which makes no charge for connecting will not in a short time so increase the number of its consumers as to be more than repaid for any possible initial loss.

SALES: THE DECIDING FACTOR.

By J. E. CHAMBERLAIN.

Business can be divided into many sections, and one of the most important—especially under existing conditions—is, without doubt, sales. To conduct the commercial side of a prosperous business on sound lines it is essential that the head of this side of the business shall be a thorough organiser, with absolute confidence in himself and a complete knowledge of the work he has to undertake.

It is necessary to analyse the meaning of the word "organiser," which at the present day is probably used rather loosely. To be a successful organiser it is necessary for a person to have a general knowledge of the work concerned, but not a highly technical knowledge of all its branches; he must be capable of controlling other people's brains and diverting them into the correct channels—also of arranging departments, so that co-operation is assured and all departments work in perfect synchronism. Consequently, it is evident that the head of affairs, or the organiser, is responsible in all cases, whether a business prospers or otherwise. This, of course, is on the assumption that the manufacturing side is perfectly organised.

The reason why a large percentage of companies are not in a sound position is because the head of affairs does not possess the qualities of an organiser; if, on the other hand, all heads were capable of organising, the right man would have the right job in all cases, and the country, on the whole, would benefit considerably.

The writer would here quote one or two cases in point: A clerk in a large concern, employing many thousands of men, has admitted that he only does two hours' real work in a day, the rest of the day is spent, in the words of the Army, in "lead-swinging." Now, imagine how much better it would be for everyone concerned, and the country in general, if all people such as this man, were

employed in useful productive work. Another example the writer is aware of is where a highly technical man is on the road. Now, this man would be valuable in the works or laboratory, whereas on the road he is almost useless, due to lack of personality. These cases are typical of hundreds, or perhaps thousands, existing to-day, and they can in practically every instance, be traced to the responsibility of the head or organiser.

It is, of course, impossible for the head of even the commercial side of a business to be in direct contact with every individual in various departments, but it is without question "up to" the head to engage people directly under him whom he knows to be capable of carrying out their duties in the manner he wishes; consequently, if the head is a perfect organiser, he will never have on his staff any member who is not absolutely efficient; or, if he does, the employé's stay will be of short duration.

There is no doubt that many sales organisations fail because of lack of co-operation; no matter how large or small a business is, without co-operation it is impossible to attain success.

Even if a man on the road is endowed with all the necessary qualifications, if he does not receive sufficient and proper backing from his head his time is wasted. On the other hand, if a man on the road is a slacker, whatever backing he receives, the results will be bad; consequently it is impossible for either combination to bear perfect fruit.

The man at the head of affairs on the commercial side of a business must be a born organiser, and the men under him should be trained by him either directly or indirectly to obtain the best results; and for the benefit of people who are at the head of affairs, because they have money invested in the concern, I say: Analyse the results, and if you are not showing a profit, blame yourself and get out, and let the man with organising abilities take the wheel, and it will be money in your pocket and to the advantage of all concerned.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We publish below a list of proposals that will come forward in the next session of Parliament (1923). Readers who are desirous of obtaining further information will find the applications published in the *London Gazette* for November 21st, 24th, and 28th.

(a) Electric Light and Power.

London Electricity Joint Committee (1920), Ltd.—Provision for the improvement of the generation of electricity for supply in the administrative County of London, supply of electricity in bulk, to allow the Central Electric Supply Co., Ltd., to transfer its undertaking to the company, powers to supply electricity to electricity undertakings and other bodies, financial powers to provide for the suspension of any rights of purchase of the London County Council or other body over any electricity undertaking in or partly in the county or of any undertaking or company having an electricity undertaking therein or partly therein; to vary the London Electric Supply Acts, 1908 and 1910, and to exclude any provisions of these Acts from applying to the company or its undertaking; and to declare the company the Joint Electricity Supply Authority for the County of London; financial powers, &c.

Oakham Gas Co.—Powers to supply electricity within their present gas limits.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—Extension of powers for the supply of electricity; further financial provisions.

Stoke-on-Trent Corporation.—Repeal, consolidation and re-enactment of Orders regulating electricity undertaking; re-definition of area of supply, powers and provisions incident to supply of electricity.

Swanage Gas Co.—To transfer to the company the undertaking authorised by the Swanage Electric Lighting Order, 1906, and of the undertaking of the Swanage Electricity Supply Co., Ltd.—Further powers with reference to the supply of electricity, including increase of charges.

Torquay.—Powers to increase electricity charges, &c.

(b) Electric Tramway, Motor 'Bus and Trolley Vehicles.

Birkenhead Corporation.—Construction of new tramways, further powers with respect to the tramway and electricity undertakings.

Chesterfield Corporation.—Further powers with reference to the Corporation's tramway and electricity undertakings; powers to run trolley vehicles and for the erection of overhead equipment; powers to run motor omnibuses within and without the borough; further borrowing powers.

Leicester Corporation.—Construction of new tramways within the city and further provisions with regard to the tramway undertaking.

London County Council.—Additional powers, including further financial provisions; extension of time for the completion of certain tramways, &c.

Lytham and St. Annes Corporation.—Continuance of the tramway undertaking of the Council; powers as regards trailers; and to run omnibuses within and outside the borough.

Maidstone Corporation.—Provision and working of trolley vehicles; powers to run omnibuses within and without the borough; further provisions with regard to the electricity undertaking.

Nottingham Corporation.—Construction of new tramways, power to increase tramway fares, further powers with respect to the electricity undertaking, to extend the area of supply, &c.

Plymouth Corporation.—Construction of new tramways, further powers in regard to the electricity undertaking, &c.

Potteries Electric Traction Co. and North Staffordshire Tramways Co.—Advancement or postponement and synchronisation of dates for compulsory purchase of undertakings (so far as they relate to tramways and light railways) of the companies, prolongation of intervals between recurring dates of purchase, requirements and provisions as to purchase, prohibition, or restriction of competition by omnibus with tramways and light railways of the companies.

Rochdale Corporation.—Construction of new tramways in the parish and borough of Rochdale; further borrowing powers.

Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.—Extension of time for the construction of the tramways authorised by the Company's Act of 1915; powers to run motor omnibuses; further financial provisions.

Thornton Urban District Council.—Powers to provide and run motor omnibuses within and outside the district.

(c) Railways.

City & South London Railway Co.—Powers to construct new railway in the metropolitan boroughs of Wandsworth, Battersea, Wimbledon, and the urban districts of Merton, Morden and Mitcham; further financial powers.

London Electric Railway Co.—Construction of new railways, including the linking-up of the Charing Cross, Euston and Hampstead Railway with the City & South London Railway, rebuilding Leicester Square station, reconstruction of Piccadilly Circus station; further financial powers.

Metropolitan Railway Co.—Additional financial provisions; extension of the time for the completion of railways authorised by the Metropolitan Railway Acts, 1912-1913.

Wimbledon and Sutton Railway.—Extension of time limited by the Metropolitan District Railway Act, 1915; further financial provisions.

LEGAL.

Ryan *v.* Scammell and Nephew, Ltd., and Kneller and Chandler.

An action arising out of damage to electrical machines came before Mr. Justice Rowlatt in the King's Bench Division on December 8th. Mr. John Harold Ryan, electrical engineer, of Middlesex Street, London, E.C., sued G. Scammell and Nephew, Ltd., of Fashion Street, London, and Messrs. Kneller & Chandler, of Southampton, for damages respecting four Siemens-Austin, 18-kW, petrol-electric generating sets, with switchboard, radiator, and baseplate tanks.

Mr. Ryan said the machines were purchased at a Government Disposal Board's sale at Richborough in 1920. He contracted with the first defendants to transport the machines from Richborough to Plaistow, and, without his knowledge, they passed on the work to the second defendants to do. A steam engine and trailer, in which the machines were being transported, overturned at Boughton Hill, near Canterbury and the machines were damaged.

In answer to Mr. Charles, K.C., for Scammell & Nephew, Ltd., Mr. Ryan admitted that a Mr. J. Worple had bought the machines at the Disposal Board sale; but, he also said, that Mr. Worple did so only under his guidance, and he (Mr. Ryan) took over the machines after the sale.

On that point Mr. Charles submitted that Mr. Ryan was not the owner of the machines at the time of the accident, and therefore he had no action. Mr. Charles also contended that Mr. Ryan knew that the second defendants were to do the transport work.

For both defendants it was denied that there was negligence on the part of the driver of the steam engine.

Giving judgment, Mr. Justice Rowlatt said he came to the conclusion on the evidence that the property in the machines was exclusively Mr. Worples's and that Mr. Ryan had none; also, that Mr. Ryan did not fulfil the requirements of a bailee for the goods, as had been contended. Therefore Mr. Ryan's action failed.

His Lordship thought Scammell & Nephew, Ltd., were entitled to employ another contractor to do the work. He held that there was negligence on the part of the engine driver in that his engine went too fast down the hill and could not be controlled. If Mr. Ryan had been entitled to recover his damages, award would have been for £150; but, as he was not entitled to recover, the action would be dismissed with costs.

Rippingille *v.* Leys Malleable Castings Co., Ltd.

At the Birmingham Assizes last week, according to a report in the *Birmingham Post*, plaintiff, an electric fittings agent of Birmingham, brought an action against defendants to recover damages for alleged breach of contract.

It was alleged that the defendants verbally and in letters from January to July, 1919, represented to the plaintiff that they were about to undertake the manufacture of conduit fittings and castings, and could accept orders up to £50,000 per annum. In July the plaintiff entered into an agreement under which it was claimed he was appointed sole agent for the defendants in the British Isles. His commission was fixed at 5 per cent., with additional commission in specified cases. The agreement was to remain in force for two years. The defendants terminated the agreement improperly, as the plaintiff alleged, on the ground that the orders executed had not reached a minimum agreed upon. Plaintiff, on the other hand said the defendants did not in fact undertake the manufacture of the articles to the extent agreed on, and did not execute orders with due despatch.

There were lengthy legal arguments, the defendants averring that they were not bound to manufacture and accept the orders given to them by the plaintiff.

Judgment was given for the defendants.

The Judge said that one of the questions he had to decide was whether the defendants were entitled, at their own discretion, to refuse to execute orders. He held that the case was outside the purview of that class of case, which said that if there was an agreement to do a certain thing for a certain term of years there was an obligation to carry out the terms of the agreement.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Estimating for Internal Wiring Contracts.

A letter on the above subject in your issue dated December 8th and signed by Mr. Alan Kirk, contains a paragraph taken from the preliminary rules of the Scottish Mode: "Schedules of Quantities shall fully, completely, and accurately represent the work to be contracted for." This sentence may be held to contain the *raison d'être* of the Scottish Mode. At one time it was customary to measure wiring and its protective covering, which is undoubtedly the most just method of assessing the value of work done but is only possible when all the work is exposed.

The next stage in the development of internal wiring produced concealed work, where it was impossible, after the completion of the job, to ascertain the extent of the work carried out, and surveyors had to accept the measurements given by the contractors, or their workmen, which measurements were often lacking in accuracy.

It must be obvious to Mr. Kirk that this method does not provide any incentive for a contractor to make the shortest possible runs for his circuit wiring, with the result that proprietors too frequently had to pay for far more material than was necessary, and received an indifferent installation, as the voltage drop in the circuit wiring was unnecessarily high. In some cases measurers refused to pay for long runs, sometimes with justice, and other times without: where, for instance, the contractor had elected to deviate from the direct path in order to maintain the amenity of a building.

The rate per point method was therefore adopted, but even then it is only applied to that portion of the work which is concealed, as the outlet boxes behind switches and lighting points are separately enumerated, and the method gives every encouragement to the contractor to do his work economically as well as efficiently.

With respect to the measurement of power points, it must be obvious to most people that the size of the conductors, and consequently of their protective coverings, depends upon the work to be done by the power point, and it is seldom that more than two power points are supplied from one pair of fuses, making the measuring of the same comparatively simple, whereas in lighting circuits there may be 10 points, and it is usual to use the same size of conductor for all the lighting service branches and the rate per point becomes an equitable method of assessing the value of the work.

I do not think that Mr. Kirk needs any reply to his query as to the reason for "Voltage affecting the question," if he considers the diverse conditions between an installation for 25 volts and one for 250 volts.

The P.M.G. some years ago altered the method of charging for parcels by post from steps of one pound to the more practical method of charging for a variation of weight in larger proportions. Mr. Kirk apparently thinks that he ought to have adopted a method whereby the cost would be in direct proportion to the weight carried. This would have involved the introduction of new postage stamps valued at one farthing and something over forty stages of payment between the minimum package, and the maximum not over eleven pounds.

The method of charging for wiring at a "Price per point" as defined in the Scottish Mode is therefore approximately but at the same time sufficiently accurate; it promotes economical methods of installing, prevents underpayment or overcharging, eliminates the possibility of distrust between contractor and measurer, and generally as has been found in practice, provides an equitable arrangement for accurately assessing the value of the work carried out.

Basil A. Pilkington.

Edinburgh, *December 11th*, 1922.

In your issue of the 8th inst., Mr. Kirk had evidently misread our letter appearing in your issue of the 1st inst. We did not say we had "made use of this method in all contracts carried out by us." We said that "we had scheduled, estimated, &c." As regards the two Redford Barracks contracts, we are sorry we did not schedule these.

While we have scheduled installations at rates per point, we have never had any objection to quoting for work scheduled by others, however weird these methods appeared to us.

Lowdon Bros. & Co.

Dundee, *December 11th*, 1922.

[Messrs. Lowdon Bros. & Co.'s letter stated: "We have scheduled, estimated, and made out our accounts practically in accordance with this Mode in all the installations we have carried out during the last 30 years, that is, before the system was introduced in the Scottish Mode."—Eds. Elec. Rev.]

The Hastings Electricity Undertaking.

With reference to Mr. Sayers's interesting letter regarding his pioneer days at Eastbourne, he seems to be under the impression that the system of high-pressure direct-current supply has only one survivor.

I would point out, however, that there are still several undertakings which have the system in use at the present day. Several of the towns in the Isle of Wight are supplied from sub-stations fed by high-pressure (2,500 volts) direct current, and here, at Twickenham, we still have two high-pressure generators running to supply sub-stations.

An interesting feature of these sub-stations is that they are controlled from the generating station and, except where batteries are installed, no attendants are necessary.

M. Farrer.

Twickenham, *December 11th*, 1922.

Electric Power for Pulverising.

I should be very glad if any of your readers could send me costs of electricity for running pulverising plant for refuse disposal as compared with crude oil or gas.

C. Culmer Hodges,
Engineer & Secretary.

Electricity Works, Dawlish.
December 11th, 1922.

The Prospects for Young Engineers Abroad.

I have just read the letter on page 265 in your issue of August 25th, asking for information about the opportunities for young engineers in the Dominions.

Canada is a vast country, and each province has conditions peculiar to itself; but I will try to give some idea of the conditions as they are in Ontario. And, I suppose, the conditions here would be more or less true for other sections of the Dominion, since Ontario is the industrial centre, and is the province with the largest engineering plants—generating and manufacturing.

Technical education, in technical schools, colleges, and university, is on a sound basis here. It is not costly to obtain, and is very democratic. Therefore, you may rely upon an abundance of fully trained technical men well versed in local methods and requirements. In electrical development, too, this province is foremost, and everyone is therefore more or less electrically able and right up to the minute in progress. Then the Hydro-Electric Power Commission is

a big field in itself for the production of men—professional and working.

At the moment, business in the industry is not brisk, and several plants are working at not more than sixty per cent. capacity. There appears no brighter outlook possible for the next few months at least.

While chances for good men are better here than in England generally, just now any man would do well to think before making a trip on chance. The men most likely to get positions at any time, and those most sought after, are those who have held responsible positions as designers of electrical equipment, or are otherwise similarly experienced.

Station-charge men can get a chance. The stations here are all a.c. twenty-five cycle, and mostly hydro power. It is this last factor which counts, because so few station men in England have had water-power experience.

Good meter-men for repair and test-room work also have a fairly good chance of getting improved conditions here.

Any young man coming out should be a graduate from a recognised centre if he desires to make progress against the young men from local technical colleges. However, as in most things, determination, grit, and energy, will go a long way.

Old London U.

Toronto, Ontario,
November 7th, 1922.

A Metering Problem.

I have for some time been anxious to register the units actually lost in a set of machines consisting of a pair of balancers and two boosters, coupled up on one shaft. The balancers are, of course, used for the purpose of driving the boosters in addition to their balancing operations.

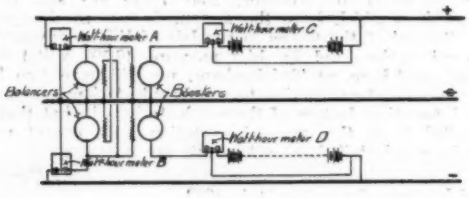
The following arrangement appears—on paper—to meet my requirements, but, before putting it into practice, I should be glad to hear if any of your readers have such an arrangement in use, and with what results.

Watt-hour meters A and B are connected up in such a way as to register the energy consumed by the booster fields in addition to the balancers' consumption.

Watt-hour meters C and D are arranged so that the pressure coils are connected across the battery terminals, thus enabling the watt-hour efficiencies of the battery to be obtained.

We will assume first that the balancers are running without the boosters in use, and with an out of balance on the system. In this case the two meters A and B would register the energy passing through. One meter would work forward, the other backwards. The units lost would be obtained by adding together the units registered by the two meters, one reading being a minus quantity.

Now when the boosters are put into use an extra load is put on to the balancers and both meters A and B will speed up in the forward direction correspondingly. The increased



energy registered by these two meters will be equal to the energy output of the two boosters + the loss in these + the extra loss in the balancers (say 15 per cent. of energy required by boosters).

The battery has a watt-hour efficiency of say 70 to 80 per cent., and it is the duty of the boosters to supply the extra energy required to make up this loss. It would appear, therefore, that the number of units lost in the battery per charge would correspond with the number of units delivered by the boosters during the same charge.

To obtain the total losses for the four machines the proposed procedure is as follows:—

Charge the battery to gassing point and note readings of all meters A B C D. At some later date again bring battery to gassing point and again note readings of all four meters. Then:

Energy consumed by balancers = $(A_2-A_1)+(B_2-B_1)$
Battery loss = $(C_2-C_1)+(D_2-D_1)$

Total losses in machines = $\{(A_2-A_1)+(B_2-B_1)\} - \{(C_2-C_1)+(D_2-D_1)\}$.

The small figures $_1$ and $_2$ represent respectively the first and second readings of the meters.

F. B. S.

December 7th, 1922.

Improvement of Power Factor.

With reference to Mr. Jones's letter in your issue of December 8th, it will be found that I have dealt with Mr. Rogers's statement regarding static condensers in the remarks which I have communicated to the I.E.E. as part of the discussion.

Mr. Rogers is evidently quite unaware of what is being done in the way of installation of static condensers, and as sales engineer for the Telegraph Condenser Co. I could take him to some of our installations of condensers connected to supplies with voltages ranging from 200 to 440, which give a return on capital outlay of nothing less than 40 per cent. per annum of the capital expended, and in the majority of cases the saving is 60, 70, and even as high as 100 per cent. per annum.

Mr. Rogers is quite unable to produce facts and figures in support of the statement he made, and in fact I challenge him to do so.

E. W. Dorey.

London, *December 9th*, 1922.

Once again I am much indebted to the correspondence columns of your excellent journal. In this case I refer to Mr. C. Jones's letter published in your issue of December 8th, 1922. Further, I am thankful to the Electrical Review for not misquoting me to the extent of some contemporary journals. In your case I will simply correct to "practical commercial proposition," and ask you to delete "commercial proposition." It is quite a while since I went into an actual problem and compared actual quotations for a specific case. Wherefore I suggest that Mr. Jones compares actual figures for, say, a 400-V problem and a 600-V similar instance. I think he will find an appreciable financial saving with regard to the latter, as by so doing he will eliminate master patents.

Further, in the case typified by Mr. Jones: Are his condensers connected direct at 400 or 550 volts, without any voltage transforming devices whatsoever? In conclusion, I hope Mr. Jones may never be called upon to tackle a condenser power factor improvement problem on a 200-V basis.

W. E. Rogers, A.M.I.E.E.

London, *December 10th*, 1922.

The "Standard" Brush Holder.

May we make further claim on your valuable space to reply to the letter from The Standard Carbon Brush Holder Co., Ltd., in your issue of December 8th, in which it states at some length the differences between its brush gear and that of Messrs. Flather & Co., Ltd. We would offer our comments and leave it to your readers to judge if these differences are improvements.

(1) Since with the majority of manufacturers various sized commutators are used with a standard radius brush ring, it is absolutely essential, to obtain correct relation between commutator and face of carbon, to have a universal movement, which can only be obtained with a circular spindle permitting adjustment.

(2) The Flather brush box spindle has a machined square end on which fits tightly a square mica bobbin. This again is a tight fit in the rocker arm, which has machined slots made on a divided jig, thus ensuring dead accuracy on a 90 deg. position. This ensures absolute rigidity with a much lower tension on the clamping screws than is possible with the Standard brush holder.

(3) The Flather spring is not covered, but does not extend over the box frame, and would not be affected in the event of a flash-over. This we think, in any case, to be unimportant with machines of modern design.

(4) The adjustment of the clock spring tension is obtained in both holders by winding or unwinding the inner coil of the spring. The type of spring used in the Flather holder has an even torque throughout the whole length travel of the brush and does not require any alteration after leaving the works. Until three years ago, the Flather gear was adjusted by a small lever in the same manner as the Standard holder, but this was abandoned in favour of the present method which has six definite positions of adjustment. The tension cannot be accidently altered, and it is as fool-proof as it is possible to make a gear.

(5) The point of removing single brush boxes is of little value, and where a brush box is held by one screw this might work loose under vibration. On the Flather type, this is impossible, as it is not only clamped but held by a grub screw. In the Standard holder it is impossible to stagger the brushes on individual spindles to compensate for uneven commutator wear. The brush spindle of the Flather gear, with its complete gang of brushes can be removed by loosening two screws and re-fixed in precisely the same relative position.

(6) The Flather holder consists of the body, which is a one-piece die casting, the spring, and clamping screws, an absolute minimum number of parts ensuring rigidity. An old spring can be removed and a new one inserted, should this become necessary, in 45 seconds.

There is another important point which has, not so far, been mentioned in this discussion, and that is that the Flather brush gear is of such a design that it can be produced at approximately a quarter of the cost of the Standard holder.

In our first letter of October 25th our main desire was to emphasise the point that the novelty of the principal points of design in this gear was by right Messrs. Flathers, but we are glad that The Standard Carbon Brush Holder Co., Ltd., have developed the discussion on the lines of the ideal brush holder, since the subject is one of the greatest interest to electrical engineers.

For **Bates & Windibank.**
E. H. Bates.

London, *December 12th*, 1922.

Electricity in Agriculture.

It seems rather surprising that it is possible for a momentous debate on the Revival of Agriculture to take place in the House of Commons in the year 1922 without any reference being made by the many prominent M.P.'s who took part in that debate to the subject of electricity. Mr. Lloyd George has long been a full-blooded apostle of electricity, but news has not apparently reached him that electricity is capable of contributing tremendously to the revival so imperatively needed on the land. Surely the fault is with electrical engineers as a body, who lag so far behind our Continental rivals in this respect. It is welcome, indeed, that the technical Press are now taking the matter up, but the backwardness of the industry as a whole where electro-farming is concerned is lamentable. Is it too much to hope that the I.E.E. will appoint an influential committee to thrash this whole matter out, and bring pressure to bear where necessary? After all, there is a limit to what Mr. Borlase Matthews and Mr. Beauchamp can accomplish, valiant as is the effort they are making.

H. W. Richardson.

Sutton Coldfield, *December 9th*, 1922.

[We refer to this subject in our leading columns to-day. —Eds. Elec Rev.]

THE TRADE POSSIBILITIES OF THE BRITISH EMPIRE.

In the course of a very interesting speech delivered at Edinburgh recently by Col. O. C. Armstrong, D.S.O., president of the Federation of British Industries, the financial state of Germany and the hostile tariff tendency of other countries were referred to. The speaker considered that it would be one of the more important tasks of the Federation during the forthcoming year to urge upon the Government that it should apply both more serious attention and more vigorous action to breaking down the hostile tariff barriers which were impeding the recovery of our trade. Col. Armstrong said that with regard to foreign markets in general, it appeared to him that we should in the immediate future look outside Europe—for instance, to South America and the Far East—for any substantial increase in our export trade. There were certain factors in existence which may be of considerable assistance to us. The force of German competition was weakening as her financial position became worse, while the present United States policy in regard to both tariffs and the inter-allied debts would have a considerable reaction upon their power to compete in external markets. The president went on to discuss the one remaining market, the possibilities of which were being widely canvassed at the present moment, namely, the British Empire. We quote his reference to this matter at length :—

"In the Empire we have great natural advantages in similarity of ideas, identity of language, and relatively favourable tariff and exchange conditions, and from the broad imperial point of view there can be no possible doubt that every step we take for the furtherance of inter-Imperial trade will in the long run redound to the benefit of the Empire as a whole and of each constituent part. But we must remember that there are many limiting factors to any immediate increase of that trade, and that we must not pitch our hopes too high. Recent discussions have referred more particularly to our overseas Dominions, namely, Australia, New Zealand, Canada, and the Union of South Africa. Now the population of these four Dominions only amounts to 22,000,000. Although we know that the purchasing power per head in most of the Dominions is high (in 1921 they took 15¼ per cent. of our exports), there is an obvious limit to the absorbing capacity of markets with a relatively small population. Again, there must be limits to the productive power of areas, however vast their potential resources, unless those resources can be developed by an adequate population.

"It would be unreasonable to expect that we could make a very substantial increase in our trade with these Dominions until sufficient time had elapsed for them to increase their populations. That such increases will serve to add strength to the present movements towards fostering local industries is inevitable. We must regard this movement from the broadest point of view, we must welcome it and assist it actively by ensuring that such developments are effected by the support of British capital lest we find that, as is already the case to a considerable extent in Canada, capital has been supplied by competing countries. If a sane and healthy development of local industries takes place with the assistance of British capital and with due regard to the real industrial potentialities of the Dominions concerned, such a development can only tend to increase the general level of prosperity and consequently the growth of our trade with such Dominions.

"These conditions are all dependent upon an increase of population, and it is of the greatest importance that the Government should, in co-operation with the Dominion Governments, expand and perfect schemes of emigration to those parts of the Empire which are in need of additional population. For these reasons we cannot look to those Dominions for any immediate assistance in facing the problem of our foreign markets. We cannot, therefore, afford meanwhile to relax our endeavours in other parts of the world.

"In India we are faced with the difficulties of the political situation and possibly of a fiscal policy which may hamper any extension of British trade. With regard to India, I am afraid we can only say that the prospects of an immediate increase of our trade must be slight, and that we may even find difficulty in maintaining it at its present level.

"I am a firm advocate of doing everything which is possible to stimulate and develop our trade within the Empire. I look to this trade to be eventually the solution of many of our present problems, both economic and political. I believe that every effort should be made to stimulate such trade and to lay the foundations for its increase, but we must realise that such an increase can only be gradual, that thought and labour must be given to the solution of the problems involved, and that we shall have need of much patience before we see the fruits of our efforts. We must remember that the development of the consumption power of any market is necessarily slow and dependent upon the power of that market to develop its own production so that the consumption can be paid for.

"Whether this development will proceed smoothly and upon sound and healthy lines will depend very largely upon the wisdom and foresight of all concerned, and particularly, perhaps, on those responsible for the financial and general policy of the Dominions themselves. Development will not be assisted if we in this country rush into ill-considered schemes, or if through a lack of appreciation of the legitimate needs and ambitions of the Dominions themselves, we attempt to force upon them schemes based too much upon our own present necessities."

THE INSTITUTION OF ELECTRICAL ENGINEERS.

South Midlands Centre: Chairman's Address.—*Abstract.*

In the course of his inaugural address at Birmingham as chairman of the above-named Centre of the Institution, Prof. W. Cramp, after paying an eloquent tribute to the late Dr. G. Kapp, said *inter alia** :—The Institution of Electrical Engineers has become indeed the nucleus and life centre of the electrical profession, inasmuch as affiliation with it in some degree has become a necessity and membership of it a hall mark. It has the ability to be a great power and influence in the world if administered with wisdom and judgment, but all great endeavours do, at the very moment when they are greatest, and even because of that greatness, contain the germ of the disease which ultimately leads to their deterioration and decay.

It behoves us, therefore, at this time specially, to search carefully the body of our Institution for indications of the presence of any such undesirable microbe.

Presidents and councils should intrinsically be servants—chosen on account of their wisdom to express and carry out the best thoughts and intentions of the community. If they do wrong, the responsibility is general and rests not upon the executive alone. Nomination, voting, and the method of election, are therefore serious privileges—far too lightly esteemed among us. This is the microbe of utter indifference, which has a hold already in us as individual members, and through us is affecting the whole Institution. It is the mild form of a very insidious disease, apparent as one of the prevailing causes of the downfall of many institutions greater than ours. It is a question of conscience for each member, to see that he votes for no man of whom he knows nothing, or of whom it may be said that he acts specifically for some "interest."

The Institution, like a huge Briareus, now spreads its hundred arms all over the world, embracing all manner of subjects, and its growth has passed unmarked because so gradual. But while thus extending our activities, let us never forget the lofty objects of the Institution lest we fall into the position of a mere trade defence organisation. There is need for this warning! Has the Institution any call to deal with German reparation payments, E.P.E.A. and suchlike semi-political trade guild work? Politics are no concern of ours, I think, and can only lead to diffusion of energy better employed in other ways; it is but a small step from reparation payments to questions of tariffs. Far better to maintain and extend our

*See Elec. Rev., November 3rd, 1922; p. 634.

original and highly successful expansion, resulting in the system of Territorial Centres. Has not the real growth and success of the Institution been due to this wise move more than any other? Mark how the Institutions of Civil and Mechanical Engineers are being obliged to follow our example in this matter.

Other institutions' kinship with us fills me with much misgiving; their number increases alarmingly and one's list of subscriptions becomes a matter of importance. Each has had its own office, staff, journal, meetings, *and subscriptions*. Curious, too, how a given subject will go the round of them with repetition of discussion *ad nauseam* and monstrous accumulation of redundant printing. Clearly the matter cannot be left where it is; co-operation or affiliation must be compassed in some manner.

But how to do it? The Inst.C.E. has called a conference on the subject and is apparently in labour. Will it bring forth anything? If not, the I.E.E. should and must take it up, as being concerned in the matter more vitally than any other. Did man ever hear the like of it? Over half-a-million sterling spent by engineers on three piles of bricks and mortar within one square mile, where some plans are indeed made, but virtually no engineering is actually done—and not so much as would shelter three blind mice in Manchester, Liverpool, Leeds, Sheffield, Birmingham, Bristol, Glasgow, or anywhere where engineers live and move and do verily make engines! Three palaces, I say; three libraries containing largely the same books, and three secretariats with all their appurtenances and vested interests. Which is going to give way?

If in London we had been content to limit our annual expenditure by a judicious arrangement with one or the other of the great Institutions, increasing thereby the present wretched load factor of their buildings, there might have existed by now an Institution library and reading room in every important centre in the kingdom. What splendid opportunities! Such a combination of interests might have led—nay, may still lead—to other advantages, of which not the least would be the reduction of our annual charges. To maintain our dignity and prestige we are content to pay not less than £18,000 every year. Our idea of the value of the papers we receive as shown by the premiums awarded is £208, and our contributions to research amount to £218. Does this indeed represent the relative importance of these items? And are not our colleagues of the other Institutions in a worse case? Ought not such a scheme of co-operation as I have suggested to be regarded as most urgent—the only way, in fact, to achieve further territorial expansion and adequately to develop the Students' Sections?

There are signs of grace upon which we are entitled to look hopefully, but far better were it to ignore them than to blind our eyes to the presence of the microbes of the disease which I have diagnosed as existing in our system and for whose extermination I submit the following prescription:—

(1) Whole-hearted devotion on the part of the rank and file to the objects for which the Institution was established; more interest in the discussions; and in the selection and election of representatives on Committees and Council. It would be well if all would read the objects as stated in the Memorandum of Association at least once a session.

(2) The elimination from our activities of any concern with political or semi-political movements, industrial relationships, or trade-guild propaganda.

(3) The encouragement and expansion of Territorial Centres and a much more generous treatment of them financially. In particular, the reduction of expenses in London in so far as that is practicable and the establishment of Institution accommodation and libraries in the provinces.

(4) Encouragement and more generous treatment of the students' sections.

(5) Co-operation and, if possible, fusion with other engineering institutions, ultimately to form one great English-speaking Institution of Engineers.

Electro-Farming.—Mr. R. Borlase Matthews, M.I.E.E., in continuation of his campaign to popularise electricity in farming, gave a lecture recently to the Hertfordshire Institute of Agriculture, at Oaklands, St. Albans. In commencing, Mr. Matthews emphasised the simplicity of electrical methods—no special training was necessary. Hay-making at the lecturer's farm was illustrated by lantern slides. The capacity for work possessed by the "unit" was explained by reference to actual cases. The lengthening of the farm day by means of electric lighting, and the use of the same agent for increasing egg production, were dealt with.

The Hertfordshire Institute has under consideration the electrification of its college farm.

Fish Netting by Electricity.—A temporary scarcity of fish in the canning industry at Stavanger, Norway, has induced certain individuals to send out to the Hardanger Fjord the steamer *Adonis*, which has been equipped with electric lighting apparatus for the purpose of attracting fish near to the surface at night. The fjord is said to the swarming with brisling, although at too great a depth to be caught at night.

RUSSIA'S FIRST REGIONAL POWER STATION.

Dr. C. P. Steinmetz, of the G.E. Co., U.S.A., writing in the *Electrical World* recently, says that the first regional power station, designed and built in accordance with the plan for Russian electrification drawn up for the Russian Government by a committee of engineers, came into being on June 11th last, when the Kashira central station began operation, transmitting electrical energy at 115,000 volts over a 130-km (81-mile) line to Moscow. To the south of Moscow lie extensive brown-coal deposits estimated at 8,000,000 tons. This is low-grade coal, containing 40 per cent. ash. It is soft and friable, and these qualities, with its low calorific value and high ash content, make it unsuitable for long-distance transportation; hence the Kashira station was built to burn this low-grade coal. The Kashira power house is connected with the railroad station by a branch line 5 km. (3 miles) long, which ends in front of the power house. The cars, laden with coal, enter directly into the boiler-room for discharge into the bunkers. In the future electric cranes and conveyors will be installed, but for the present use is made of pits. All the auxiliary railways are to be electrified and the cars are to be hauled by electric locomotives supplied at 1,200 V, d.c., with a truck having two axles, on each of which a 120-h.p. motor will be mounted.

As the station is on a high elevation with respect to the midsummer water level, it was necessary to build a pumping system on the bank of the river. Since in the spring the water rises very high at this part of the river, the pump-house is built in the form of a tower, and it is also adapted for an ice-cutting plant. The pump-house contains three 260-h.p., three-phase, 50-cycle, 3,000-V motor-pumps, each having an output of 2,500 cu. m. (88,290 cu. ft.) per minute. In view of the present lack in Russia of a sufficient quantity of cast-iron piping, the water is conveyed in wooden piping held together by iron rings. At the present time there are in operation two turbo-generator sets with a temporary transformer-house and one boiler-house. An extension of the building to contain two more turbo-generator sets and another boiler plant, and a house for transformers, distributing boards, and high-pressure apparatus, are under construction. At the present time there are installed three Garbé boilers with a heating surface of 450 sq. m. (4,815 sq. ft.) each, two B. & W. boilers with horizontal tubes and a heating surface of 302 sq. m. (3,230 sq. ft.) and two Stirling boilers with a heating surface of 515 sq. m. (5,510 sq. ft.) each, making a total heating surface of 3,434 sq. m. (36,740 sq. ft.). The boilers are fitted with economisers.

In the boiler-room adjoining the turbine-room are the feed-water heaters and four pumps, two electric pumps, and two turbo pumps, with an output of 135 cu. m. and 120 cu. m. (4,765 cu. ft. and 4,236 cu. ft.) respectively.

In the turbine-room are installed two three-phase, 3,000-V, 50-cycle, Brown-Boveri turbo-generators, rated at 6,000 kW each and separately excited. Railroad tracks are laid directly into the turbine-room. For its own needs the power station has two 750-kVA, 3,000/210-volt transformers and one reserve motor-generator set for excitation purposes.

On the second floor is the main distributing board, which controls the station generators and the outgoing lines. Under the switchboard are 3,000-volt oil switches and connecting switches. Close by is temporary accommodation for single-phase, 4,000-kVA. delta-star-connected, step-up transformers, with 3,000/115,000 volts between phases.

All the oil switches are calculated to interrupt 40,000 kVA under short-circuit, the whole output of the station.

The Koszuchow sub-station is situated to the south of Moscow, close to the station of the Moscow-Okrouszny railroad. The sub-station transforms the voltage received from Kashira to the city voltage (6,600) and to that of the high-voltage ring which is to surround the town, following the lines of the Okrouszny railroad.

The transmission line which carries the output of the Kashira station to Moscow is noteworthy because it is the first 115,000-volt transmission line built in Russia, and because it has been constructed entirely by Russian engineers of Russian material, with the exception of the high-pressure insulators, and under the most trying conditions. Another high-pressure line will be built from Kashira and two high-pressure lines from Shatouka to Moscow. From the Koszuchow sub-station underground cables carry the energy to the Moscow lines. Copper-conductor stranded cable is used with a cross-section of 70 sq. mm. (0.11 sq. in.) and a diameter of 11 mm. (0.4 in.). Instead of iron supports wooden poles 11 m. (36 ft.) high, with a top diameter of 22 cm. (8.8 in.) are used. Wooden supports were used only because the present position of Russian industry makes it very difficult to procure steel supports. It is recognised that wooden supports require replacement on an average once every seven years, and that this will interfere with the operation of the line. For this reason steel towers will be used later on.

BUSINESS NOTES.

The "Electrical Review" Issue for December 29th.—We desire to direct the attention of our advertisers and readers to the announcement appearing in our advertisement pages to-day respecting the dates for sending in copy for our issue of December 29th. All editorial matter must reach us much earlier than usual, as the greater part of the REVIEW will have to be "made up" before the Christmas Holidays begin.

Bankruptcy Proceedings.—CAPT. DANIEL DESMOND SHEEHAN (formerly for eight years Nationalist member of Parliament for Mid-Cork).—A Belfast newspaper report states that the creditors in this case met on December 6th at the London Bankruptcy Court. The liabilities are estimated roughly at £600, while a creditor has given notice of his intention to lodge an additional claim for £2,500. Debtor denies he is insolvent, and values his assets at not less than £13,000. They comprise interest valued at £25,000 in 68,000 acres of mineral rights in Western Ireland, to be developed directly the country becomes more settled, and interest valued at £10,000 in profits of a syndicate formed to utilise the water power from the River Bann for electricity, for which an unopposed Bill is now before the Ulster Parliament. A trustee was appointed.

H. N. MILES (Sheffield & Midland Schools of Wireless Telegraphy), wireless instructor, Central Chambers, High Street, Sheffield.—Receiving order made December 5th on debtor's own petition.

E. MITTON, electrical and automobile engineer, Queen's Hall Buildings, Church, Lancaster.—First meeting December 18th, at the Official Receiver's offices, Preston. Public examination: County Court House, Blackburn.

R. A. DEPLEDGE (Scunthorpe Electrical Co.), electrical engineer, 53, Frodingham Road, Scunthorpe.—Last day for proofs for dividend, December 22nd. Trustee, Mr. S. M. Forrester, 1, Town Hall Street, Grimsby.

W. H. BORROWS, engineer and electrician, Werrington, Northampton.—Last day for proofs for dividend. Mr. J. O. Morris, Official Receiver, 5, Petty Cury, Cambridge.

D. H. GRIFFIN (Midland Electric Co.), electrical engineer, 16, Hornby Road, Blackpool, and 5, The Mart, St. David's Road South, St. Annes-on-Sea.—Receiving order made December 8th, on debtor's own petition.

A. SMITH (Smith & Gill), electrician, 57, Albion Street, Nelson.—Receiving order made December 7th on creditor's petition.

H. S. ROGERS, electrical engineer's sales manager, 21, Derby Street, Walsall.—Last day for proofs for dividend, December 27th. Mr. S. W. Page, trustee, 30, Lichfield Street, Wolverhampton.

Company Liquidations.—BELL BATTERY CO., LTD., Laburnum Grove, Ilford.—*Correction.*—In the list of creditors in this case (*see* ELEC. REV., December 1st, p. 825), the Electrical Engineering & Equipment Co., Ltd., appear as creditors for £678. We are informed by the company that this is incorrect, as the goods represented by that sum had not been delivered, and they are not pressing any claim. A letter from the liquidator (Mr. F. Wilcock) says that although the company appeared in the books as creditors for £678, the goods were never delivered to the Bell Battery Co., but were otherwise disposed of, and the Electrical Engineering and Equipment Co., Ltd., have now waived their claim.

AQUA ELECTRIC CO., LTD.—A meeting of members is called for January 11th at 5, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. C. H. McKnight.

WIRELESS APPLIANCES, LTD. — Winding up voluntarily. Liquidator: Mr. H. E. Harwood, 73/75, Albion Street, Leeds. Meeting of creditors, December 21st, at the Midland Grand Hotel, St. Pancras. Particulars of claims must be sent to the liquidator by January 10th.

SUBMARINE MOTOR SHIP CLEANER SYNDICATE, LTD.—Last day for proofs for dividend, December 28th. Mr. H. E. Burgess, Official Receiver and liquidator, Carey Street, W.C.

Dissolution of Partnership.—D. M. CARMICHAEL & ROBERTSON, wholesale electrical suppliers, 32, Abbotsford Place, Glasgow.—Mr. D. M. Carmichael and Mr. T. C. Robertson have dissolved partnership.

Receiver Appointed.—WILSON HARTNELL & Co., LTD., Leeds.—Mr. Peter McCandlish Wilson, of Lee & Whitfield, chartered accountants, 17, East Parade, Leeds, has been appointed receiver for the second debenture holders.

Trade Announcements.—MESSRS. G. H. STEVENS & Co., electrical engineers and contractors, who have moved to 108, Fenchurch Street, London, E.C., desire to receive catalogues.

MESSRS. MENZIES-SMART, LTD., have changed the address of their London office to 11 and 13, Southampton Row, London, W.C.1. Telephone No.: "Museum 4413."

MR. E. BRYIAN-HASELDEN has taken over the business of P. J. Weekes, Lombard Works, Lombard Street, London, S.E.1, for the manufacture of switch panels, &c.

STAIDARD INSULATOR CO., LTD., has removed to more commodious and central premises at 41, Rathbone Place, Oxford Street, W.1.

MR. COLIN C. STEWART, formerly with the late Mr. Hugh Clark, has commenced business as an electrical engineer at Alloway Chambers, 239, High Street, Ayr.

MR. WILLIAM R. ALSTON has succeeded to the business of the late Mr. Hugh Clark, electrical engineer, 10, Alloway Street, Ayr.

THE LEWIS SPRING CO., LTD., Redditch, has appointed Messrs. Lionel Robinson & Co., of 3, Staple Inn, Holborn, W.C.1, sole agents for the electrical trade for its products.

Catalogues and Lists.—MESSRS. CROW, TOOGOOD & Co., 56, High Street, Charing Cross Road, W.C.2.—A priced catalogue of electrical fittings and appliances; a pamphlet illustrating the "Crogood" lantern for external lighting, and the "Rhodes" time switch; and a net trade price list of electrical appliances and material.

MADA ENGINEERING CO., LTD., 12, Bevington Hill, Liverpool.—An illustrated booklet (List G), fully describing the "Remca" electric riveter. Also an illustrated postcard giving the price of this machine.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 2251-A, illustrating and describing d.c. motors; and Descriptive List No. 4305-C dealing with porcelain handle fusible cut-outs.

MR. RALPH W. COWIN, 46, Churchill Road, Oldham.—An illustrated pamphlet dealing with special casing for exposed conduit.

THE LODGE FITTINGS CO., LTD., 57, Albert Road, Aston, Birmingham.—A priced leaflet and sheet of illustrations of lighting pendants. Also a leaflet giving prices and specifications of battery switchboards.

MESSRS. NATHAN & ALLEN, LTD., 25, Victoria Street, S.W.1.—An illustrated catalogue of electric time switches and ancillary apparatus. Fully priced.

MR. E. BRYIAN-HASELDEN, Lombard Works, Lombard Street, Southwark Bridge Road, S.E.—A pamphlet advertising lighting service, with a calendar for 1923.

THE GEAR GRINDING CO., LTD., Handsworth, Birmingham.—An illustrated pamphlet advertising a patent gear hardening and grinding process.

CONSTRUCTORS (TRADING CO.), LTD., 4, Brook Street, St. Paul's Square, Birmingham.—An illustrated and priced pamphlet dealing with "Welconstruct" slotted steel—flat, angle, and channel.

THE SYNCHRONOME CO., LTD., 32 and 34, Clerkenwell Road, E.C.1.—A booklet containing lists of some important installations of "Synchronome" electric clocks.

THE RUSSELL ELECTRICAL APPLIANCES CO., LTD., 60, Queen Victoria Street, E.C.4.—An illustrated and priced pamphlet describing the "Reako" heater-toaster and a domestic iron.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—An illustrated and priced pamphlet illustrating the "Cheery" electric fire, a new model.

MESSRS. FERGUSON, PAILIN, LTD., Edward Street, Higher Openshaw, Manchester.—Catalogue Section No. 190/A1, giving a detailed illustrated description of the firm's truck-type ironclad switchgear.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A series of illustrated pamphlets in a folder advertising "Benjamin" industrial illumination.

Christmas and New Year Holidays.—The offices of the LANCASHIRE DYNAMO & MOTOR CO., LTD., will be closed from noon, December 23rd, to 9 a.m., Wednesday, December 27th, and from 5 p.m., December 29th, to 9 a.m., January 2nd. The works will be closed from noon, December 23rd, to 9 a.m. January 2nd. The works of MESSRS. BRUCE PEEBLES & Co., LTD., will be closed from December 29th to January 8th.

Book Notices.—The Christmas number of *Work* (Cassell and Co., Ltd.; 3d. net) is of larger size than usual, and contains many articles and notes upon scientific entertainments for the season. A special article deals with the reception of radio broadcasting, and there are numerous electrical notes by Mr. A. H. Avery.

"The *Journal* of the Junior Institution of Engineers." December. London: Percival Marshall & Co. Price 2s.—A paper on "Artificial Ice-making," by Edgar C. West is reproduced in this issue, and a report of the annual general meeting also appears.

"Science Abstracts A. and B." Vol. XXV. Part 10. No. 298. October 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

Irish Property Claims.—The Dublin United (Electric) Tramways Co. has lodged a claim for £1,608 with the Irish Free State Government in respect of damage to property during recent political disturbances. Marconi's Wireless Telegraph Co., Ltd., is claiming £7,199 from the Government in respect of damage by the "Irregulars" at the Clifden (Co. Galway) wireless station.

A Pen-knife Sharpener.—The Pelican Electric, Ltd., has sent us one of its sharpener slips for pen-knives. It is in a red American cloth case, and of very serviceable size.

New Belgian Wireless Company.—A new company has been formed in Brussels, with a capital of 4,000,000 fr. and the title La Société Belge Radio-Electrique. The Compagnie Générale de Télégraphie Sans Fil, Marconi's Wireless Telegraph Co., Ltd., and several other concerns are interested in the new undertaking.

Social.—The London Station Engineers (Branch No. 1), Electrical Trades Union, held their sixth annual concert on December 8th. An excellent musical programme was arranged, and the audience numbered about 300. During the interval a successful collection was taken in aid of the branch benevolent fund.

Visit of Swedish Engineering Students.—A report has recently been published of the visit of Swedish engineering students to England during the past summer. This was arranged on the initiative of the Department of Overseas Trade and the British Commercial Secretary at Stockholm, and the Swedish Commercial Board offered each of the visiting students 500 kr. to defray their expenses. The party was divided into sections, each of which paid attention to its particular branch of engineering. Power stations, manufacturing works, gasworks, shipyards, and other works were inspected, both the technical and economical sides being studied. The programme included visits to the London Underground Railways, the Metropolitan-Vickers Electrical Co., Ltd., Messrs. Ferranti, Ltd., Messrs. Waygood-Otis, Ltd., Messrs. W. & T. Glover, Ltd., Messrs. C. A. Parsons & Co., and Messrs. Hadfield's, Ltd.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Batometa. No. 427,951. Class 8. Electric meters, apparatus for testing or indicating the condition of electric batteries, &c. Percy J. Gumbley, 39, Morley Road, Ward End, Birmingham. November 22nd, 1922.

Metrovick. Nos. 428,500, 428,501, and 428,502. All goods in Classes 5, 14 and 15 respectiively. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. December 6th, 1922.

Lokap. No. 426,719. Class 6. Machines for winding coils for use in wireless telegraphy and for other electrical purposes. John F. Sutton, 18, Melford Road, East Dulwich, S.E. December 6th, 1922.

Marconi. No. 425,707. Class 8. Wireless telegraph apparatus. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C. December 6th, 1922.

Meccolite. No. 428,655. Class 8. Crystals for wireless communicating apparatus. Frank Hornby, 236, Binns Road, Old Swan, Liverpool. December 6th, 1922.

R.S. (lettering and design).) No. 430,089. All goods in Class 8. Radio Service Co., Ltd., Evelyn House, 62, Oxford Street, London, W. December 6th, 1922.

A.D. Le Carbone (lettering and design). No. 427,336. Class 11. Electric batteries. La Société Le Carbone, 12-13, Rue de Levallois, Levallois-Perret (Seine), France. (D. Young, 11-12, Southampton Buildings, London, W.C.). December 6th, 1922.

Lelios. No. 425,210. Class 13. Electric lamps (ordinary). Lelios Lamp Co., Ltd., 32-34, Holborn Viaduct, London, E.C. December 6th, 1922.

Resolco. No. 428,418. Class 13. Electric lamps (ordinary) and electric lighting fittings and accessories. Good Bros., Ltd., 35, South John Street, Liverpool. December 6th, 1922.

Our Foreign Trade.—NOVEMBER FIGURES.—The following were the values of imports and exports of electrical goods and machinery during November, 1922:—

	1922. Nov.	Inc. or dec.	1922. 11 months Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus	177,643	+ 44,807	− 458,407
Machinery	651,171	+ 3,027	− 2,889,197
Exports.—			
Electrical goods and apparatus	647,653	− 143,242	− 5,582,446
Machinery	4,818,822	−1,205,171	−22,183,852
Re-exports.—			
Electrical goods and apparatus	6,172	− 5,143	− 61,444
Machinery	97,857	+ 627	− 150,919

Trade Union Membership.—The Chief Registrar of Friendly Societies, reporting upon the membership of trade unions during 1920, states that there was an accession of 400,000 persons, making the total membership over 7,000,000. Under "General and Miscellaneous" 1,644,659 members are placed. In the metals industry there were 1,134,389; transport workers numbered 1,091,889; and mine workers 1,007,617. A feature of the year was the number (more than 20) of non-manual workers' unions registered. Several amalgamations took place, and 19 unions disappeared from the register owing to these.

"Model Engineer" Exhibition.—The sixth "Model Engineer" Exhibition is to be held at the Royal Horticultural Hall, S.W., from January 5th to 12th. An interesting and instructive display is being arranged.

Russian Electrical Industry.—According to a Russian journal, the output of the electrical industry in Russia in 1916 was valued at over 83,000,000 pre-war roubles. Later the industry suffered a severe decline. In 1920 the output was valued at only about 5,000,000 pre-war roubles, or about 6 per cent. of that of 1916. A change came in 1921, when the output of electrical goods was over 8,000,000 roubles in value, or about 20 per cent. of that of 1914 and 10 per cent. of that of 1916. With regard to the year 1922, a special committee has been examining the situation of the four electrical trusts—The Central District Trust; the Petrograd District Trust; the Accumulator Trust; and the Weak-Current Trust. The position of these trusts, deprived of working expenses, and short of labour, was similar to that of the metallurgical industries. Between January 1st and May 1st this year the Central District Trust produced goods to the value of 3,662,000 pre-war roubles, but could only realise a very small proportion, namely, about 760,000 pre-war roubles value. Its "funds" largely consist of unsold goods made for Government departments unable to pay for them, and of raw and semi-raw materials (over 7,000,000 roubles value), which cannot be used for some time. The finished goods are valued at about 10 per cent. of the working capital. The position of the Petrograd Electrical Engineering Trust is no better. Its output from January 1st to May 1st was valued at 1,100,000 roubles, of which it realised 230,000 roubles, or about 20 per cent. of its products. The old pre-Revolution firms had a great system of branch establishments in the country; but these have ceased to operate. The first step of the new trusts was to open such branches for the supply of electro-technical materials. The Central District Electrical Trust has now established ten or twelve such branches. Before the war Russia's own electro-technical workshops covered 60 per cent. of Russia's requirements, and the present production is estimated to amount to about 25 per cent. of the pre-war output, or about equal to one-fifteenth of the pre-war demand. The demand from the agriculturists, it is stated, is now very strong, and it is felt that in the near future Russia's electro-technical industry will revive on a solid basis. It is held that many Government orders are going abroad that could quite well be executed in Russia. The inquiry committee points out, for example, that the Weak-Current Trust should get more home support. A large quantity of Morse apparatus has been bought abroad, whilst Russian factories are idle. The writer continues that it is only a good market that is wanted to put the industry on its feet—our readers may give a very wide meaning to the term "good market"! Before the war the inland accumulator works covered Russia's requirements to the extent of 98 per cent. Their production amounted to 2,900,000 roubles value. But between January and May this year this Trust produced only to the value of 120,000 roubles, of which only 35,600 roubles value was realised! This trust works only for Government departments. The Weak-Current Trust is similarly situated.

Longevity of Exide Batteries.—Some few months ago a Melbourne, Australia, client of the Chloride Electrical Storage Co., Ltd., visited the firm's Service Station with his Hudson car, which he had just sold. He was anxious that everything on the car should be right before handing it over, and instructed the depôt staff to open up and inspect his "Exide" battery, type 12-SD-3. On examining it, it was found that the battery needed no repairs, and was good for further service. At that date it had been in use for 9½ years, and at one time stood in a garage for nine months—and then started the car. The battery is still in service.

New Italian Companies.—There has been formed at Savona the Società Anonima di Elettricita di Savona, with a capital of 6,000,000 lire, which may be raised to 8,000,000 at the request of the Commune of Savona. The objects of the company are the construction and working of electrical undertakings.

With a capital of 900,000 lire the Società Elettrica del Santerno has been embodied at Venice. Its aims are the purchase, erection, and working of industrial and electric plants, more especially in the Imola district.

Commission on Awards to Inventors.—Lieut.-Colonel Joseph I. McMullen, head of the Commission appointed by the Government of the United States to settle the claims of British inventors whose work was made use of by the United States Army during the war, is in London making arrangements for the first sitting of the Court of Investigation. Members of the Commission landed at Plymouth on December 6th. The whole of the work is to be done in conjunction with the British Commission on Awards to Inventors, and in every case the decision arrived at will be after full discussion with the British representatives.—*Daily Mail.*

A Reply from the East.—Mr. F. H. Howell, the London Sales Manager for "Hotpoint" and "Falco" heating and cooking appliances, informs us that our recent note on the special terms offered to electrical salesmen to assist them in the acquisition of appliances for their personal use has not only brought many replies from this country, but even from so far away as the Sudan.

New French Companies.—There has been launched at Paris (41, Boulevard Haussmann) the Compagnie Francaise d'Installations et Exploitations Electriques (G. Gilbert et Cie.), with a capital of 1,000,000 fr., with objects as indicated by its title.

The Radio Industrie is a company founded to cater as makers and sellers for the newest departures in wireless telegraphy and telephony. Its capital is 200,000 fr. Offices: 25, Rue des Usines, Paris.

With the object of the sale in France and her colonies of the magnetos made by the Italian firm of Marelli, the Société Francaise des Magnetos Marelli has been established with a capital of 250,000 fr. Offices: 77, Boulevard Gouvion Saint-Cyr, Paris.

Lea Coal Meters at Kilmarnock.—We are informed by the Lea Recorder Co., Ltd., that it supplied the coal meters fitted to the triple-grate B. & W. boilers illustrated in fig. 2 on p. 831 of our December 1st issue. In view of the fact that these meters are, at the present time, somewhat novel appliances, it is pleasing to know that Mr. W. C. Bexon, engineer and manager of the Kilmarnock electricity undertaking, is very satisfied with them.

South African Tariff.—The South African Customs authorities have lately given a decision to the effect that "wireless telegraph apparatus and wireless broadcasting sets" are to be classified under No. 193 of the Tariff, the general duty being at the rate of 20 per cent., from which British goods are allowed a rebate of 3 per cent.

Vacuum Cleaner Prices.—The Electric Appliances Co., Ltd., have issued notice to the trade reducing the prices of their Eureka vacuum cleaners.

Installation Work in Paris.—The last issue of the weekly report of the French Minister of Labour on the labour market states that in the Department of the Seine the activity of the electrical installation firms is being maintained, and the available labour is insufficient to meet the demand.

Indian Trade.—His Majesty's Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.) has forwarded to the Department of Overseas Trade a brief review of the September issue of the monthly trade returns issued by the Government of India, with regard to the import trade of the first half of the statistical year—April 1st to September 30th, 1922. It is stated that the total imports for the six months declined from 124 crores of rupees in 1921 to 110 crores in the corresponding period of 1922. It is, however, most satisfactory to note that, although shipments from the United Kingdom declined slightly from 69 to 66¼ crores, the British share of the total rose from 55 per cent. to 60 per cent., as contrasted with a reduction of the share of the United States from 10.3 per cent. to 6.6 per cent., and that of Japan from 6.6 per cent. to 5.9 per cent., but the German proportion rose from 2.3 per cent. to 2.7 per cent., and the share of Belgium remains stationary at 0.9 per cent. It should always be remembered, however, that imports from British ports do not entirely represent British goods, as there is a certain amount of Continental cargo shipped from British ports by British export merchants.

Owing to the trade depression and the parlous state of many Indian industries, the phenomenal imports of machinery and millwork which were recorded last year have not been maintained during the first six months of the present year. The total imports fell from 17.8 crores to 11.43 crores. The British share was reduced from 14.18 to 9.62 crores. This reduction is, however, less severe than in the case of the United States, whose shipments fell from three crores to one crore. The only noteworthy increases are those of Germany from 29 to 39 lacs, and of Switzerland from three to nine lacs. The total imports of electrical machinery were 154 lacs (186), and of boilers 60 lacs (141).

The very heavy imports of electrical instruments and apparatus have not been maintained, and the total trade is reduced from 260 to 118 lakhs. The British share fell by more than half, from 175 to 82 lakhs, while that of the U.S.A. shrank from 62 to 11 lakhs. The only noteworthy increase is that under the heading of "Other countries," from 6½ to 12 lacs, and this probably represents mainly German electrical accessories.

German Heating and Ventilating Congress.—A heating and ventilating congress is to be held in connection with the 25th yearly meeting, in Berlin in 1923, of the Union of Central-Heating Industries.

LIGHTING AND POWER NOTES.

Alford (Lincs.).—Electricity Scheme.—The Urban Council has referred to the Lighting Committee a proposal by Mr. J. W. H. Cooper, of Grimsby, to institute an electric lighting scheme for the town.

Argentina. — Hydro-Electric Scheme. — The Argentine Ministry of Public Works has made a proposal to the Legislature of the Province of Mendoza for the installation of a hydro-electric plant and irrigation dam at the Nihuil Falls, on the River Atuel. There is a fall of 100 metres in a distance of 500 metres, while the gorge is not more than seven metres wide at its narrowest point. The mean annual flow is 40 cubic metres per second, with up to 500 cubic metres during the rainy season. The proposed development of electrical energy amounts to 40,000 h.p.—*Reuter's Trade Service.*

Ashford (Kent).—Electricity Supply.—At a recent meeting of the Urban Council, the engineers appointed to report on the possibility of an electricity supply wrote stating that the Electricity Commissioners were not prepared to sanction an independent generating station for Ashford unless a supply of energy in bulk could not be obtained. The matter was referred to the Lighting Committee.

Australia.—Western Victoria.—Plans for the supply of electric power from Yallourn to the larger centres of population in Gippsland have been submitted to the State Ministry by the Electricity Commission. The annual estimated cost of operating the scheme is £18,012. If authorised this year the project can be brought into operation in two years. The starting point of the proposed extensions will be the State Government's power station at Yallourn (Morwell). The works include a transmission line 90 miles long, *via* Traralgon, Sale, Maffra, and Stratford, to Bairnsdale, the estimated cost, including sub-stations, to be £77,720; a transmission line 49 miles long *via* Mirboo and Leongatha to Korrumburra, the estimated cost to be £32,300; and a transmission line six miles long to Moe, to cost £2,130, bringing the total capital cost to £112,150. It is pointed out that this is for the complete system of h.p. transmission only, and does not include the cost of l.p. distribution in townships or interest during construction.—*Reuter's Trade Service* (Melbourne).

Bedford.—Year's Working.—The accounts of the municipal electricity undertaking (Engineer: Mr. R. W. Phillips) for the year ended March 31st last show a total revenue of £72,709, as against £78,705 in the preceding year. Working expenses totalled £48,237, as compared with £54,572, leaving a gross profit of £24,472 (£24,133). The net result, after the payment of interest and sinking fund charges, was a profit of £1,736; the previous year's profit was £2,139. A total of 4,611,267 kWh of energy was sold, and the maximum demand was 2,680 kW.

Blackpool.—Loan.—The Corporation is applying to the Electricity Commissioners for sanction to borrow £33,000 for the following purposes: H.p. feeder cables, £7,400; l.p. feeder cables and distributors, £10,100; 10 new static transformer buildings, £3,500; ten 200-kW transformers, £2,000; switchgear, £4,000; and services, £6,000.

Continental.—France.—Power is being sought by the Société d'Etudes Saône-et-Marne to erect a transmission line to carry 30,000 V, 50 cycle current from Challandrey to Mirabeau and six secondary transmission lines to serve some eight localities in the Côte d'Or and Upper Marne districts. The Société Anonyme pour l'Eclairage par le Gaz is applying for a concession to distribute electrical energy in eight communes in the neighbourhood of the city of Rheims. A concession to distribute electrical energy in eleven rural communes in the department of the Somme has been applied for by the Société Cooperative Agricole d'Electricité de Sains-en-Amenois. The Compagnie d'Electricité Industrielle has applied for a concession to set up three e.h.p. transmission lines to serve a number of communes in the Haute Garonne and Basses Alpes departments. A syndicate, whose headquarters is at the town hall, Vignory, has applied for a concession to supply electricity to 24 communes in the valleys of the Marne and the Blaise.

Belgium.—The plant at the new Louis Lambert colliery of the Société des Charbonnages d'Hensies-Pommeroeul is to be electrically operated, the plans including the establishment of an electricity generating station. An electric winding engine has been installed, and is already being used in connection with the shaft sinking work, and will be utilised later for coal-raising purposes.

East Ham.—Accident.—During the testing of a new rotary converter at the Council's generating station on December 10th, the machine flashed over, and four of the station employés received burns.

Eccles.—Price Reductions.—The Town Council has reduced the charge for electricity from 75 per cent. above the pre-war rate to 50 per cent. as from the quarter ending September 30th.

Greenock.—Fire.—While a large turbine was in operation at the Corporation electricity station on the night of the 8th inst. there was a "burn-out," and flames burst forth, igniting the roof and shattering glass. The Burgh Fire Brigade extinguished the flames. The main portion of the town was in darkness for some considerable time.

Guildford.—Price Reductions.—The following reduced charges have been adopted by the Town Council:—Lighting, up to 1,000 kWh per quarter, 9d. per kWh; beyond, 6d. Power and heat, up to 1,000 kWh per quarter, 3½d.; beyond, 2½d. The minimum charge for each quarter is to be 10s., plus meter rent. Theatres and kinemas, up to 100 kWh per week, 6d., beyond 3d.

India.—Madras.—The Municipal Council has been in correspondence with the Government electrical engineer regarding estimates for lighting by generating the necessary power with

oil-engines. The engineer has replied that the scheme may be worked at a cost of Rs. 60,000.

Bombay.—The Andhra Valley Power Supply Company has commenced supplying power to cotton mills in Bombay to the extent of 2,000 h.p. The supply will be increased as mills are adapted to electrical drive. By July next it is expected that Bombay will utilise the whole of the Andhra Valley supply.—*Indian Textile Journal.*

King's Lynn.—Year's Working.—The accounts for the year ended March 31st last of the electricity undertaking (engineer: Mr. C. W. Jackson) record a total income of £17,760, as compared with £16,659 in 1920-21. Working expenditure amounted to £11,261, as against £12,959 in the previous year, leaving a gross profit of £6,499 (£3,700). After the payment of capital charges a net profit of £544 remained, contrasting favourably with a net deficit of £106 upon the previous account. The sales of energy decreased from 882,314 to 837,067 kWh. The number of connections increased from 1,144 to 1,228. During the year 1,000 kW was added to the plant capacity—more than doubling it.

London.—Hackney.—The *Evening News* states that the borough electrical engineer (Mr. L. L. Robinson) is considering the illumination of market stalls by electricity. A standard with a meter would be erected in the market place, and the stalls would be connected up to this, receiving energy at a low cost, which would compare favourably with that of other forms of lighting.

Mexico.—Nonoalco.—According to the report of the Mexican Light & Power Co., Ltd., for the year 1921, a contract has been placed with the English Electric Co., Ltd., for a 5,000-kW steam turbo-generator for the company's Nonoalco station, to be ready for operation before the next dry season. The new plant will replace three old and obsolete machines.

Middlesbrough.—Extension of Supply.—The Corporation has decided to supply electricity to the neighbouring villages of Ormesby and Marton provided that for a period of six years a guarantee is given by the residents to pay 10 per cent. of the cost of laying the transmission lines. The Corporation has decided further that in the event of the necessary guarantee being given, the Town Clerk shall be instructed to apply to the Electricity Commissioners for sanction to the borrowing of £4,000 to carry out the work.

Newton-in-Makerfield.—Electricity Supply.—It was stated at a meeting of the Gas Committee last week that the Electricity Commissioners had considered a scheme for a generating station in the Council's area, and also an alternative proposal of obtaining bulk supplies from outside the area. They also had had under consideration a scheme submitted to them for a re-organisation of electricity supplies over a district in which Newton-in-Makerfield would be a part, but some time would elapse before it would become operative. The Commissioners therefore urged the Council to take bulk supplies from available sources.

Oakham. — Electricity Scheme. — The Urban District Council has appointed a sub-committee to consider the scheme of the gas company to supply electricity for heating and lighting purposes in the area.

Portuguese East Africa.—Beira.—Additions to the present power station amounting to 300 h.p. have been decided upon by the Town Improvement Commission. The additional plant is to improve the lighting system of the town and to provide electrical energy during the day for industrial and commercial purposes. Tenders will be called for in the near future.—*Commerce Reports.*

Rochdale.—Price Reduction.—The Corporation has reduced the charges for electricity by 10 per cent.

Rye (Sussex).—Proposed Electricity Scheme.—The Town Council has decided to appoint an expert to advise it upon an electricity scheme for the town.

Sleaford.—Price Reductions.—The charges for electricity have been reduced as follows:—Power, from 7½d. to 5½d. per kWh; heating, from 8½d. to 5½d. per kWh; lighting, from 10d. to 9d. per kWh; public lighting to be reduced for the current half-year by 10 per cent. on the full charges of £18 15s. for arc lamps and £3 for small lamps.

Southampton. — Year's Working. — The report of the borough electrical engineer (Mr. W. G. Turner) for the year ended March 31st last records a total income from all sources of £148,423, comparing with £143,216 in the preceding year. The working expenditure totalled £96,643, as against £110,654, giving an increased gross profit of £51,780 (£32,562). After the payment of capital charges, a net profit of £26,660—or more than twice that of the previous year, £10,587 remained. The capital account shows an expenditure of £108,818 during the year. Of this total new machinery accounted for £75,196, buildings for £17,895, and mains and services for £12,657. The number of kWh sold fell from 10,916,989 to 9,335,592. The maximum load also decreased from 5,111 to 4,986 kW. Southampton is one of the few towns which were not seriously affected, financially, by the miners' dispute; the increased price of coal during that period was more than counterbalanced by later reductions. The decreased sales of energy were entirely due to the loss of industrial load; the consumption for private purposes increased.

Stafford.—Loan.—The Town Council has agreed to the recommendation of the Electricity Committee that an e.h.p. cable be laid from the works along Stone Road to the Sandon Road factory of Messrs. Lotus, Ltd., for the purpose of supplying electricity to the company's factories, and that application be made to the Electricity Commissioners for sanction to borrow £15,000 in connection with the scheme.

Swansea.—Price Reductions.—The Electricity Committee has recommended that the following reductions in the charges for electricity be made, commencing January 1st, 1923:—Lighting, from 6½d. to 6d. per kWh; heating and cooking, from 2d. to 1d. per kWh during the summer quarters; power, a reduction of 25 per cent.

Wanstead. — Special Order. — The County of London Electric Supply Co., Ltd., is applying for an Order to enable it to supply electricity to Wanstead, Woodford, Buckhurst Hill, and Chigwell. The matter is to be considered by the Wanstead District Council in conjunction with the Woodford Urban District Council.

Wellingborough. — Extension of Supply. — The Rural Council has consented to the application of the Northampton Electric Light and Power Co. to extend its area of supply, so as to include the parishes of Mears Abbey, Ecton, Sywell, and Earls Barton.

Wimbledon.—Year's Working.—The accounts of the municipal electricity undertaking for the year ended March 31st last show a total revenue of £87,359, as compared with £81,459 in the previous year. Working expenses totalled £59,200, as against £66,642, leaving a gross profit of £28,159 (£14,817). The net result was a profit of £5,894, comparing favourably with a deficit of £3,699 in 1920-21. The number of kWh sold increased from 4,013,525 to 4,277,808, and the maximum demand from 2,501 to 2,725 kW. The plant capacity remained at 4,285 kW.

Hire of Domestic Appliances.—The Borough Council has authorised the expenditure of £200 for the purchase of electrical cooking appliances to be let out on hire.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Accident.—On December 10th a tramcar proceeding to Birmingham along the Handsworth route left the track and, after proceeding about 20 yards, overturned. There was no appreciable gradient at the place where the accident occurred, but the *Birmingham Post* states that there was a length of 4 ft. of rail which appeared to be considerably worn. Fortunately there were only five passengers in the car at the time, but these and the driver and conductor were all injured. Only the driver was detained at the hospital.

Chile.—Railway Electrification.—A commencement has been made upon the important Chilean electrification project to supply power for the railway between the capital, Santiago, and the port of Valparaiso. The stretch of 190 km. forms the first standard gauge railway in South America to be electrified.—*Reuter's Trade Service.*

Continental.—France.—The Conseil Général of the department of Ile-et-Vilaine has decided to purchase the tramway network of the Société des Tramways Bretons at a cost of 1,400,000 fr., with the view of handing it over to a company for conversion to electrical working, estimated to cost 2,500,000 fr. The tramways serve the towns of Saint Malo, Saint Servan, and Paramé. It is expected that the purchase will be completed by March or April, 1923, and electrification will be started by 1925.

Mexico.—Railway Electrification.—The survey of the section of the Mexican National railway between Monterey and Cerneros, which it is proposed to electrify, has now been completed and the signature of the President of the Republic is all that is needed in order to put the scheme into effect.—*Reuter's Trade Service.*

Newport.—Proposed Light Railway.—The Rural District Council has appointed a sub-committee to meet a committee of the County Council to consider the steps to be taken in connection with the proposed light railway between Newport and Four Ashes.

Pontypridd.—Sunday Cars Proposal Rejected.—The Urban District Council has decided against the running of Sunday tramcars at present, and the offer of the Rhondda Tramways Co. of £240 per annum for a working arrangement has been rejected.

West Hartlepool.—Railless Car Scheme Delayed.—Unexpected difficulties have arisen in connection with the Corporation's railless car scheme for the Foggy Furze route. It was announced at a recent meeting of the Council that the Ministry of Transport could not sanction the borrowing of £9,600 until the Council had obtained powers to carry out the work; also that the Ministry of Health had declined to confer these powers by Provisional Order, and had pointed out that it would be necessary to proceed by Bill. The cost of a Parliamentary Bill, it was stated, would be between

£500 and £600. The chairman of the Tramways Committee said that the machinery had been ordered, and if a special Bill were necessary the scheme would be put back practically for twelve months. It was decided that the Chairman, the Town Clerk, and the local member of Parliament should interview the Ministry of Transport with the object of obtaining powers by Provisional Order rather than by Bill.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Communication Service.—Figures relative to the operations of the Postmaster-General's Department for the year ended 1920-21 show that the total expenditure for all purposes was £8,268,725, against £6,649,432 for the previous year. The total revenue of the department for 1921 was £8,511,494, of which the amount received from the telegraphs was £1,401,606, and telephones £2,450,981. Telegrams despatched numbered 17,196,644 while cablegrams received and despatched totalled 950,670. With regard to the telephone service, there were at June 30th, 1921, 2,553 exchanges in the Commonwealth, to which were connected 240,507 instruments. The revenue earned was £2,450,981, and the expenditure on construction work £1,244,083.—*Industrial Australian and Mining Standard.*

Argentina.—Broadcasting.—The first broadcasting concession granted by the Municipal Government of Buenos Ayres is about to be exploited in Argentina. It has been given to a native engineer, and is confined to the provision of subjects of an educational and recreational nature. In this connection an installation of radio-telephone transmitting apparatus will shortly be required. The concession is in no way a monopoly, the Government reserving to itself the right to grant similar favours to other companies, although not upon quite the same favourable terms as those conceded to the first applicant.—*Reuter's Trade Service.*

Denmark.—Telephone Profits.—Owing to the amount of its profits, the Copenhagen Telephone Co. has decided to grant a bonus of 8 per cent. of the year's subscription to all subscribers who paid their subscription throughout 1922.—*Daily Mail.*

France.—Radio-Communication.—Communication by radio-telegraphy was established on December 6th between France, Algeria, and Tunis, on the one part, and Syria, Palestine, and Egypt, on the other part. The charge per word has been fixed at 1 fr. 30, and urgent telegrams at triple rates. Press messages and telegrams at deferred rates will be accepted.—*Reuter* (Paris).

Direct raido-communication between Bordeaux and Saigon was opened in the beginning of August, the tariff being 2 fr. per word, or less than the charge by cable. French colonies which are now equipped with receiving posts will shortly be fitted with transmitting plant. They are: Martinique, Guinea, and Rufisque (in West Africa), Djiboutil (in East Africa), Brazzaville (in Equatorial Africa), and Antananarivo (Madagascar). It is stated that in 1926, when these works are completed, two new stations will be built in the Pacific, which will complete the chain of stations linking up the 90,000,000 inhabitants of France and her colonies.—*L'Industrie Electrique.*

Japan.—Radio-Telephony.—According to *Commerce Reports*, an application for Government sanction to establish a radio-telephone system has been made by the Daido Electric Power Co. of Nagoya, Japan, which proposes to operate the system primarily for its own convenience in connecting the various stations of its electric power system, but its use may be extended eventually to the general public if sufficient demand should arise. The system will start from Okuwa, in Nagano Prefecture, on the Central Japan Railway line, from which point communication will be established through Nagoya and as far as Osaka, a distance of about 150 miles.

Radio-Telegraphy.—Imperial Chain Stations.—According to the daily Press, Mr. G. Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., recently discussed the decision of the Cable and Communications Committee of the Empire Press Union to press the Government for a declaration of policy with regard to Empire radio-telegraphy, and to ask the Postmaster-General to receive a deputation before the end of the year. After pointing out that the Governments concerned had given his company concessions for the erection of radio stations in South Africa, Australia, and Canada, he explained that application had been made to the General Post Office for a licence to erect the necessary stations in this country. Licences had also been promised over two years ago by the late Government for the erection of stations in this country to communicate with foreign countries. Plans are ready, sites have been selected, and the work, upon which the company estimates to spend £2,000,000 sterling, can be put in hand within a few hours of receipt of the Government consent. Mr. Isaacs estimated that from the date of getting the necessary licences the Marconi Co. would complete the Empire chain in eighteen months.

Reception on Moving Vehicles.—The Technical Department of the National Railways of Mexico is engaged upon studies with a view to installing radio telegraphy upon the whole of the trains run by the Government.—*Reuter's Trade Service.*

Radio-Telephony.—Travelling to Welwyn Garden City by train from King's Cross on December 7th, Mr. A. O. Joyce, of the British Thomson-Houston Co., listened-in for half an hour to the news broadcast from Marconi House. His receiving set measured only 12 in. square by 4 in. deep.—*Daily Mail.*

Russia.—Broadcasting.—Reuter's Agency learns that among the latest batch of telegrams received by the Russian Trade Delegation from Moscow is the following: "The systematic broadcasting of concerts, speeches, and lectures is being organised. A concert will be broadcast daily."

Indo-European Service.—The Indo-European Telegraph Co. has completed the repairs of the wires from Odessa to the Polish frontier, and a direct telegraph service between England and Odessa *via* Berlin and Warsaw is shortly to be established.—*The Times.*

South Africa.—New Radio Station.—Mr. McLellan, of the Marconi Co., has been charged with the construction of the new station, which will give a direct service to practically every country in the world. Work will start immediately the agreement has been ratified by Parliament, and it is expected that it will be completed in eighteen months' time. As far as possible the material will be purchased in South Africa.—*Reuter.*

The Telephone Service.—New Exchange.—A new telephone exchange has been opened at the Udny Post Office, and forms one of the links in the interconnection of rural districts in Scotland.

Uruguay.—Telephone Service.—The Montevideo Telephone Co. ("La Uruguaya"), acting under instructions received from its board of directors in London, will shortly bring an action before the Courts against the Uruguayan Government for having obliged it to increase the salaries of its personnel. The company likewise is said to have received instructions as to the attitude it has to adopt in the event of the Montevideo Post Office Department deciding not to proceed with the negotiations it entered into some time ago for the acquisition of the company's property.—*Review of the River Plate.*

Radio-Legislation.—Recent modifications of the rigid laws governing the installation of radio-telephone and telegraph stations have made broadcasting possible. Applications are pending which, if granted, should mean the opening of a splendid market for radio-telephone receiving apparatus in Uruguay.—*Commerce Reports.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Atherton.—December 20th. Urban District Council. Two 30-kVA, single-phase transformers and one 150-kVA ditto. (December 1st.)

Australia.—Melbourne.—January 24th. Tramways Board. 1,650 steel poles, either solid or in three sections.

March 7th. Electricity Commissioners. Ash and dust extraction plant. (See this issue.)

January 24th. Victorian Railway Department. Insulated copper wire.*

January 31st. Three-phase a.c. motors, starting apparatus, and accessories for the Newport workshops (17 enclosed squirrel-cage motor sets, 2 h.p. to 20 h.p., two enclosed slip-ring motor sets, 25 h.p. to 30 h.p.).—*Reuter's Trade Service* (Melbourne).

Sydney.—January 31st. New South Wales Railways Department. Four 1,000-kW rotary converter sets.

Newcastle (N.S.W.).—January 11th. Town Council. 750-kVA or, alternatively, one 1,000-kVA transformer voltage regulator.—*Reuter's Trade Service* (Melbourne).

Basford (Nottingham).—January 1st. Board of Guardians. Economiser. (See this issue.)

Belgium.—January 6th. Municipal authorities of Saint Gilles-lez-Bruxelles. 800-kW motor-generator; h.p. asynchronous motor, and d.c. generator. Service de l'Electricité, 40, Rue de Bethléem, Brussels.

Birmingham.—January 27th. Salvage and Stables Committee. Plant for the refuse destructor and salvage works:—One 3-wire balancer set and switchgear for lighting purposes; two 110-kW steam-driven generator sets, with switchgear and condenser; one 5-wire balancer set, with switchgear and charging panels, for electric vehicle charging; paper press; scrap-iron press; hydraulic accumulator and pumps. (See this issue.)

Bolton-upon-Dearne.—December 21st. Dearne District Light Railways Committee. Construction and equipment of the Dearne District Light Railways.—Rails and fishplates; points and crossings; permanent way, road widening, and bridge works; overhead line equipment; feeder cables; sub-station plant; rolling stock; buildings. (December 1st.)

Cheadle and Gatley.—January 1st. Urban District Council. Sub-station switchgear and static transformer. (See this issue.)

Dublin.—December 18th. Dublin United Tramways Co. (1896), Ltd. Stores for six months. (December 8th.)

Dundee. — December 22nd. Electricity Department. Supply of .5 sq. in. and .2 sq. in. l.p. single lead-sheathed cable, also a quantity 2½ in. x 2 in. x 2½ in. 3-chase troughing. (See this issue.)

France.—PARIS.—January 3rd. Multiple town switchboard. Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Huddersfield.—December 18th. Board of Guardians. Electrification of laundry, Crosland Moor Institution. T. W. Armitage, clerk to the Guardians, Union Offices, Ramsden Street, Huddersfield.

India.—MADRAS.—January 18th. Corporation. Eight 30-kVA, 3-phase transformers; h.p. switchgear; 15,000-V testing set; 700 30-ft. steel tubular poles; 10 tons h.d. copper wire, No. 8 gauge; 6 tons g.i. wire, No. 8 gauge; switchboard instruments. Specifications, &c., Revenue Officer, Corporation of Madras (Rs.1 per set).—*Reuter's Trade Service* (Calcutta).

Manchester.—January 1st, 1923. Rivers Committee. Conversion of Davyhulme sewage works, Urmston, from steam to electric drive. Secretary, Rivers Department, Town Hall, Manchester.

New Zealand.—WELLINGTON.—January 30th. Posts and Telegraph Department. 2,000 g.i. earth-rods, 5 ft. x ½ in.*

Nuneaton.—December 20th. Electricity Department. One balancer, complete with switchboard panels and accessories. (December 8th.)

South Africa.—BRANDFORT, O.F.S.—January 30th. Municipal Council. Water-tube steam boilers, steam engines and alternators, switchboard, boiler and engine-house auxiliaries, steel poles and overhead conductors (erected), transformers, house services and meters. Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.—*Reuter's Trade Service.*

Torquay.—December 18th. Electricity Committee. Two 400-kW rotary converters and one 300-kW rotary converter, complete with transformers, switchgear, and accessories. (December 1st.)

Uruguay.—MONTEVIDEO.—January 16th. State Electricity Works. 45,000 metres v.i.r. cable.*

, December 29th.—L.p. armoured cable, telephone cable and accessories.*

Warrington.—December 19th. Board of Guardians. Supply of electrical goods for three months for Warrington Union. Mr. A. Bottomley, clerk to the Guardians, Bewsey Chambers, Warrington.

Wolverhampton.—January 17th. Electrical Engineer's Department. One 5,000-kW turbo-alternator, condenser and auxiliaries. (See this issue.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen.—Corporation. The Electricity Committee recently invited offers for a 10,000-kW turbo-alternator, with condenser and pumps. Nine complete tenders were received —three for the turbine and alternator—and seven tenders for the condenser and pumps only. Three Swiss firms sent in offers. The highest offer (all British) for the combined set amounted to £46,500; and the lowest (all Swiss) £30,340. The lowest satisfactory combination of plant (all British) amounted to £41,130. It was stated that the main difference in price was in the steam turbine portion of the set, British offers, where they were disclosed, ranging from £21,000 to £17,510, whereas a Swiss turbine of well-known make, and one guaranteed to be of equal efficiency to British, was offered at £9,145.

Reporting on the tenders, the Corporation electrical engineer stated that if the Committee decided to place part of the order in Switzerland and thereby save a sum of at least £8,250, the most satisfactory and the cheapest combination would be as follows :—

British.—Alternator by the English Electric Co., Ltd.; condenser and pumps by Vickers, Ltd., £23,735. Swiss.—Turbine by Messrs. Escher, Wyss & Co., Zurich, £9,145; a total of £32,880.

If the tender was placed in this way, the Engineer suggested that the English Electric Co. should be made the main contractors for the combined set, and that the acceptance should be subject to a satisfactory agreement being come to as regards the general conditions of contract. The Electricity Committee agreed that the contract be apportioned as recommended by the Engineer, and the Town Council has now approved this.

Australia.—SWAN HILL.—Shire Council. For its new electricity project, the Council has accepted the tender of Homewood & O'Neill, Melbourne, for complete power-house equipment at £14,034. The plant will be of United States manufacture.—*Reuter's Trade Service* (Melbourne).

SYDNEY, N.S.W.—Municipal Council. With regard to a letter received from Oerlikon, Ltd., representing that preference was given to British manufacturers in resepect of tenders received by the Council, and dealing with the international economical aspect of the question, the Municipal Council has had a report by the City Electrical Engineer, stating that he had explained to the Oerlikon Co. that the Electricity Supply Department deals with tenders on a purely commercial basis—*i.e.*, it recommends the acceptance of a tender which, in the opinion of the officers of the Department, offers the Council the best value for the money, quite irrespective of any sentimental or patriotic consideration. The question whether any other tender than that which gives the greatest commercial advantages to the Electricity Department should be specially considered is one for the members of the Council and not for the officers of the Electricity Supply Department.

Bradford.—Tramways Committee.

Materials for tramway track reconstruction, Nab Wood (Shipley) section.

230 tons silicon steel flat-headed rails, at £10 per ton.—Dorman, Long and Co., Ltd.
6 tons welded rings, 1 ton clips, and 1 ton bolts and nuts (£180).—Smith and Hardcastle, Bradford.
25 tons round mild steel (£272).—Crossley & Davenport.
3 tons steel tie bars (£57).—Bayliss, Jones & Bayliss, Ltd.
Copper rail bonds.—British Insulated & Helsby Cables, Ltd.

Electricity Committee.

Covering boiler drums, steam pipes, &c., for No. 4 boiler house, Valley Road, with heat insulating material.—Hornby & Partners, Ltd.

Blackpool.—Fylde Water Board. Accepted:—

Electric motor.—Swedish General Electric, Ltd.

Corporation. Accepted:—

Electrically-driven locomotive travelling crane and grab for charging cells at refuse destructor.—Messrs. J. M. Henderson & Co., Aberdeen.

Dover.—Electrical installation at Messrs. Freeman, Hardy and Willis's premises.—J. L. Etheridge & Co.

Glasgow.—Tramways Committee. Recommended:—

4,200 tons of steel rails and fishplates (£41,000).—Cargo Fleet Iron Co., Ltd., Middlesbrough.

Tenders received from German and Belgian firms were lower.

London.—L.C.C.—Highways Committee. Recommended: —Switchgear for No. 4 turbo-generator at Greenwich power station :—

Metropolitan-Vickers Electrical Co., Ltd. (recommended)	**£1,441**
General Electric Co., Ltd.	1,550
Ferguson, Pailin, Ltd.	1,608
New Switchgear Construction Co., Ltd.	1,653
A. Reyrolle & Co., Ltd.	1,656
Switchgear & Cowans, Ltd.	1,681
Bertram Thomas	1,708
Park Royal Engineering Works, Ltd.	1,800
Whipp & Bourne, Ltd.	1,884
Nalder Bros. & Thompson, Ltd.	1,969

Luton.—Board of Guardians. Accepted:—

Installing electric lighting at the Workhouse (£88).—Mr. E. W. J. Whitelock.

New Zealand.—Wairarapa Electric Power Board. Accepted:

Insulated cable (£8,425).—Tolley & Son.
Bare wire and cable boxes (£12,197); l.p. insulators and bolts (£2,755).—P. R. Baillie & Co.
2,000 h.p. insulators and pins (£518).—Lawrence & Hanson Electric Co.—*Tenders.*

AUCKLAND.—Power Board. Accepted :—

300 miles of aerial cable, .007 to .3 sq. in.—Johnson & Phillips, Ltd.

Perth.—Corporation. Accepted:—

Electrical work in connection with the erection of vertical stoking plant at the Corporation gas works.—McEwen & Worbey, Perth.

South Africa.—Tenders recently accepted by Johannesburg Council :—

Two 10,000-amp. bus-bar shunts, complete with meters and leads, and one 8,000-amp. ditto (£200).—Saaler & Franks, Ltd.
6,000 ft. twin cable (£300); 3,004 ft. concentric cable (£294).—Telegraph Manufacturing Co.
11,850 yd. of twin, 3-core cable and concentric cable (£5,012).—Henley's S.A. Telegraph Works, Ltd.
Twin cable, 3-core cable, triple concentric cable, twin concentric cable (£2,748).—Metropolitan-Vickers (S.A.) Electric Co., Ltd.—*S.A. Mining and Engineering Journal.*

Southampton.—Messrs. Worthington, Simpson, Ltd., have secured the contract for the 14 sets of centrifugal pumps for the large floating dock now under construction for the London & South-Western Railway, Southampton.

Ware.—Urban Council. Accepted:—

Electrification of the plant at the waterworks pumping station (£370).—North Metropolitan Electric Supply Co.

THE ASSOCIATION OF CONSULTING ENGINEERS AND ITS CHAIRMAN.

Mr. A. M. Sillar, M.Inst.C.E., M.I.Mech.E., M.I.E.E., who presided at the annual dinner of the Association of Consulting Engineers, is the second electrical chairman that this organisation has had since its incorporation in the year 1913. The first electrical engineer selected for the position was Mr. Frank Gill, the present president of the Institution of Electrical Engineers, who held the office when he was a member of the firm of Gill & Cook, consulting engineers.

The chairmanship of the Association of Consulting Engineers is one carrying no small distinction, as may be understood from the fact that members of such very old-established consulting engineering firms as T. & C. Hawksley, Alexander Binnie, Son & Deacon, James Mansergh & Son, John Taylor & Sons, and Henry Rofe and Son have served on the Committee.

It is an office of electrical distinction, too, if only by reason of the fact that electrical matters occupy a considerable portion of the time of the Committee. Among other subjects dealt with during the present year has been the compilation and issue of a standard set of Conditions of Contract for use by members in connection with mechanical and electrical engineering contracts, and a similar set of conditions for export work is now practically completed. The Association has also been represented on various Committees convened by the Institution of Electrical Engineers, and on committees of the British Engineering Standards Association.

As the official representative of the consulting branch of the engineering profession, the Association is constantly in touch with Government Departments and with representative associations of manufacturers and contractors on matters affecting consulting engineers or their clients.

Mr. A. M. Sillar,
Chairman of the Association of Consulting Engineers.

The main aims and objects of the organisation include the association together for mutual co-operation and protection of those engineers whose work is of a purely consultative character, and members are bound by a set of rules set forth in the little grey official booklet wherein a consulting engineer is defined and his qualifications for membership are set forth. This little booklet contains a list of members, and deals, among other things, with the relations between client and consulting engineers, fees, and so on.

It will be remembered that the Association was formed in 1910, with Mr. A. H. Dykes as honorary secretary; that post he still retains, and it is to his untiring efforts that the Association mainly owes the prosperity and prestige which it has acquired.

Mr. Arthur Molyneux Sillar, whose election as Chairman took place in May last, has had a very prolonged and varied experience of electrical engineering work, as we show later in this article. He started his engineering career in the works of the "Jablochkoff" Co. in 1882, and was engaged on the Thames Embankment lighting and also in one of London's first electricity supply stations situated in Belvedere Road, Lambeth, from which, by means of cables across Waterloo Bridge, was effected the lighting of Covent Garden Theatre, the Gaiety Restaurant, and a number of buildings in the Strand. He remained with this company and its successors for 12 years, first as assistant and subsequently as chief engineer, afterwards entering into partnership with the late Mr. R. F. Venner.

In 1896 Mr. Sillar commenced practice as a consulting engineer, the firm being Lacey, Clirehugh & Sillar, and later Lacey, Sillar & Leigh, and since 1913 he has practised alone.

Amongst other schemes for local authorities and companies with which he has been connected are the original power generation and distribution systems, tramways or light railways, for the towns of Batley, Blackburn, Bournemouth, Bury, Colchester, Middleton, Ratcliffe, Rawtenstall, Rochdale, and Swindon, as well as the Corporations of Belfast and Salford, the Lancashire Power Co., the Trafford Power Co., and the London & North-Western Railway Co. He is also acting as consulting engineer to the Post Office for the equipment of its tube railway, and to a number of other electricity supply undertakings both in this country and in the Far East.

The members of the Association over which he presides comprise, of course, engineers practising in all the various branches of engineering — aeronautical, roads, bridges, docks and harbours, water supply, town sanitation, engineering chemistry, gas production, mechanical engineering, mining and metallurgy—in addition to electrical engineering.

It should be a source of satisfaction to electrical people to see that an Association which, as we have mentioned, comprises representatives of very old-established firms who have for several generations specialised in civil engineering works, has chosen as its chairman a representative of one of the younger branches of the engineering profession, for it is in some measure an indication of the position now held by electrical engineering.

On Wednesday last week the annual dinner of the Association of Consulting Engineers (Incorporated) was held at St. Stephen's Club; the chairman, Mr. A. M. Sillar, presided, and there were present over 100 members and guests, including Lord Queenborough, Sir Tom Callender, Col. T. C. Ekin, Mr. Frank Gill (President I.E.E.), Dr. Hele-Shaw (Pres. I.Mech.E.), Mr. W. W. Lackie (Electricity Commissioner), Sir Lynden Macassey, Mr. Justice McCardie, Rear-Admiral Monro, Brig.-General Magnus Mowat, Sir Evelyn Murray, Mr. A. C. Peake (Pres. Law Society), Sir Wilfrid Stokes, Sir John E. Thornycroft, and Sir Ellis Griffith.

After the toast of "The King," Mr. Frank Gill proposed "The Association of Consulting Engineers,"

defining a consulting engineer as a man who gave unbiased advice and was free from business ties. Mr. A. M. Sillar, chairman, in responding, paid tribute to the labours of the honorary officers (Messrs. A. H. Dykes, secretary, S. R. Lowcock, treasurer, Cash, auditor, and F. E. Wright, solicitor), by which the Association had been brought to its present high position.

Mr. A. H. Preece proposed "Engineering Industries," laying stress on the importance of the personal element in engineering contracts, and the necessity of "playing the game." Sir Tom Callender responded, remarking that business was improving every day, though but slowly, and that the world-wide scope of engineering ensured it a great future both at home and abroad.

Mr. J. M. Moncrieff proposed "Bench and Bar," with the members of which their relations were so cordial, and Mr. Justice McCardie replied with a humorous speech, while Mr. G. M. Freeman, also responding, lamented the days when hundreds of Bills were brought before Parliament in a single session, and the olive branch was less prevalent.

Mr. S. R. Lowcock proposed "Our Guests," who, he said, were in the majority; remarking that there were few engineers in Parliament, he said that if politicians paid as much attention to the laws of economics as engineers did to the laws of nature, the country would be much better off. Sir Evelyn Murray and Mr. E. Honoratus Lloyd responded, after which Sir Wilfrid Stokes proposed "The Chairman," and Mr. Sillar briefly responded.

THE LIVERPOOL ELECTRICITY AND TRAMWAY UNDERTAKINGS.

RECENT DEVELOPMENTS: AUTOMATIC SUB-STATIONS.

The Corporation of Liverpool purchased the business of the Liverpool Electric Supply Co. in 1896, and that of the Liverpool United Tramways and Omnibus Co. in 1897. Energy was furnished by four generating stations, equipped with Lancashire boilers and d.c. dynamos, coupled to Willans high-speed engines, the total capacity of the plant being about 3,000 kW.

The building of two new stations was commenced in 1899 and 1900. Gradually all the older stations were converted into sub-stations, and a new station, Lister Drive No. 2, was commenced in 1904, and was equipped with four 2,000-kW British Westinghouse horizontal turbo-alternators, and six 2,000-kW Curtis-British Thomson-Houston vertical turbo-alternators. The total output of this station when completed was 20,000 kW.

In 1911 it was decided to replace the whole of the original plant in the No. 1 station, and the plant now comprises one 10,000-kW British Westinghouse turbo-alternator, two 6,000-kW, fig. 1, and two 3,500-kW British Thomson-Houston turbo-alternators and two 2,000-kW British Westinghouse d.c. turbo-generators,

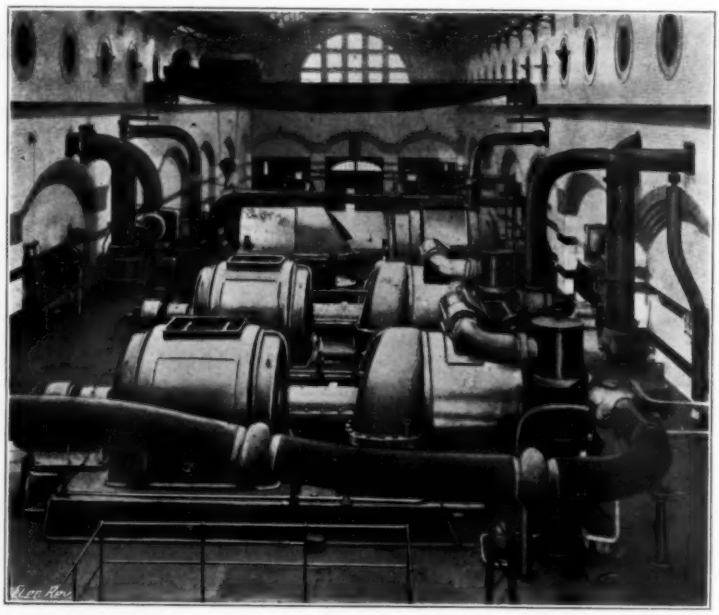


Fig. 1.—Engine Room No. 1.

Fig. 2.—Boiler House, No. 1 Station.

the total output having been raised from 8,400 to 33,000 kW.

The No. 1 station boiler house, fig. 2, contains 24 Babcock & Wilcox 25,000-lb. boilers, each having a heating surface of 6,182 sq. ft., a pressure of 200 lb. per sq. in., chain-grate stokers, a superheat of 200 deg. F., and a Green economiser containing 192 tubes.

In 1919 it was found necessary to reconstruct the plant in the No. 2 station, and the four 2,000-kW British Westinghouse sets were replaced by two 12,500-kW Metropolitan-Vickers turbo-alternators, fig. 4, running at 3,000 r.p.m. with 25 per cent. overload capacity for two hours on a 0.8 power factor.

On December 14th one of the new 12,500-kW turbo-generators was officially set to work and, with the exception of a similar set previously installed in Liverpool, we believe this to be the largest turbo-generator set yet designed to run at 3,000 r.p.m.

The turbine is materially smaller than the generator. It is mounted directly over its condenser, which will deal with 162,000 lb. of steam per hour and maintain a vacuum of 27½ in. when supplied with cooling water at 84 deg. F., and the circulating water is supplied by a 24-in. centrifugal pump driven by one of two 500-h.p. electric motors, the other being a stand-by. The cool-

ing surface is 23,500 sq. ft. 26-in. centrifugal pumps extract the condensate, and they are driven by electric motors of 30 b.h.p. running at 1,440 r.p.m. The air extraction is effected by ejectors.

The generator supplies 3-phase energy at a periodicity of 50 cycles and a voltage of 6,600. The temperature rise under full-load conditions is 40 deg. C., and with a 25 per cent. overload its efficiency is 95 per cent.; at full load, 94.5 per cent.; at three-quarter load, 94 per cent.; at half load, 90 per cent.; and at quarter load, 81.5 per cent. The machine is cooled by a flow of 50,000 cu. ft. of air per minute, which is passed through a water cooler to ensure that its temperature on reaching the alternator does not exceed 80 deg. F.

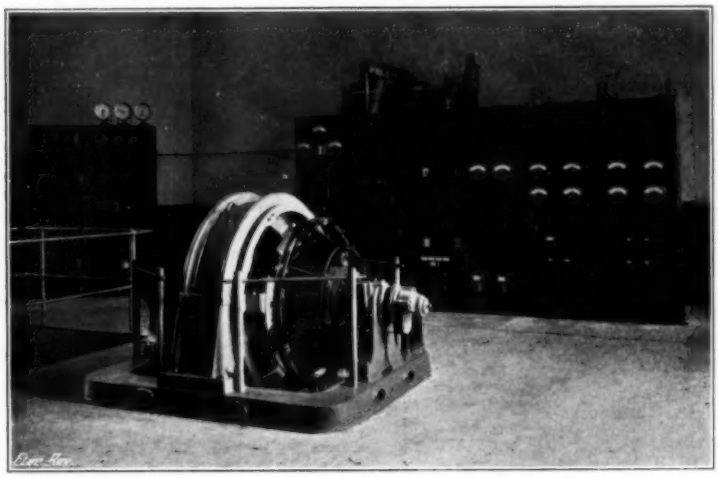


Fig. 3.—Walton Automatic Sub-station.

The turbine consists of one compounded velocity stage followed by ten Rateau stages and then by a multi-stage exhaust which is one of the novelties of the design. All stages have a mean diameter of 42 in., and with the usual type of design this would provide a "leaving" area of some 16 sq. ft., but by means of the multi-stage exhaust an effective "leaving" area of over 23 ft. is provided, so that the "throw away" loss to the condenser is said to be as small as if the exhaust end were on the double-flow principle.

The rotor embodies some unusual mechanical features. At the exhaust end the wheels are not much larger than the rotor shaft, and are made in halves and security against considerable centrifugal force is obtained by meshing collars turned on the wheels, and similar collars turned on the shaft; the whole being riveted together.

A 460-volt battery capable of giving a discharge of 1,000 amps. for one hour is available to be used in cases of emergency for auxiliary plant and station lighting.

The total output of this station, after alterations, is 37,000 kW, and the combined output of Nos. 1 and 2 stations after reconstruction is 70,000 kW in place of the original combined capacity of 28,400 kW.

The control board is situated in No. 2 station for the

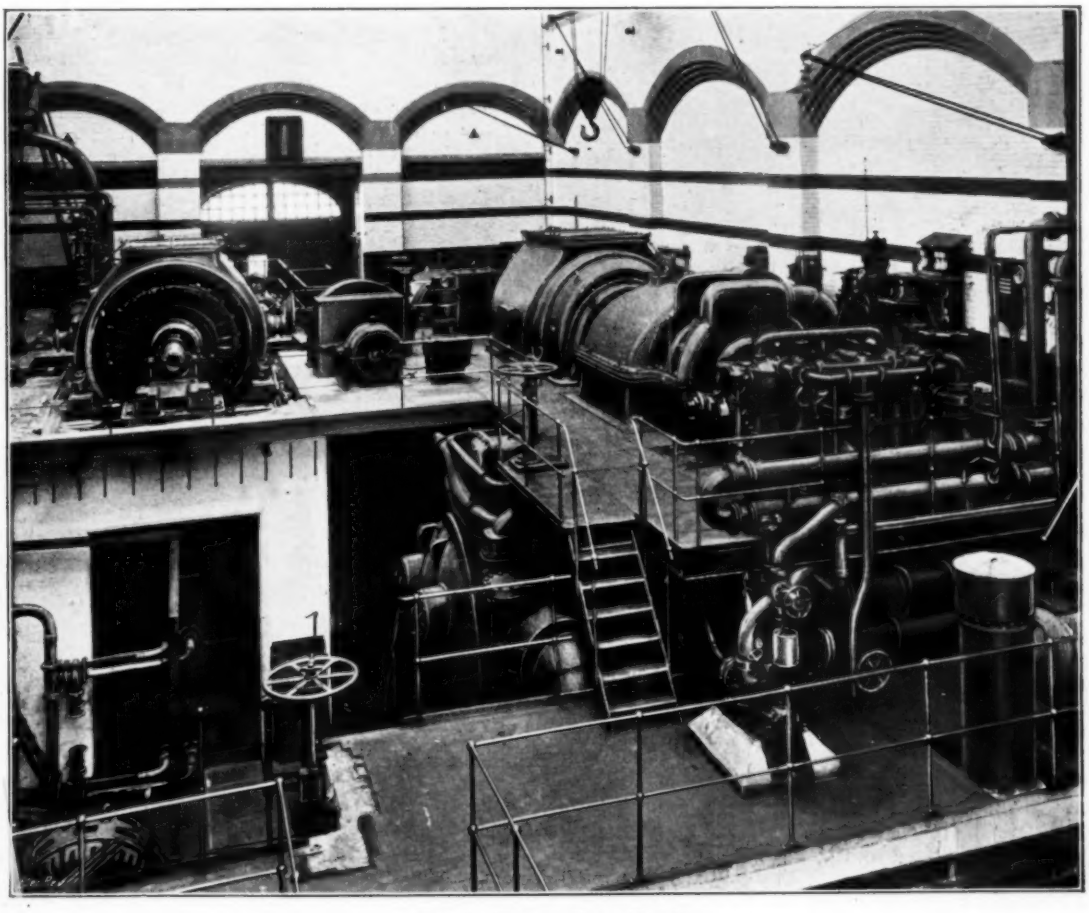


Fig. 4.—Engine Room No. 2.

whole of the h.p. plant. For the control of the two 12,500-kW turbo-alternators and works transformers a new switch room has been built on the roof of the station.

The outgoing feeders number 29, and each leads to a sub-station. Three-phase h.p. distributing mains are

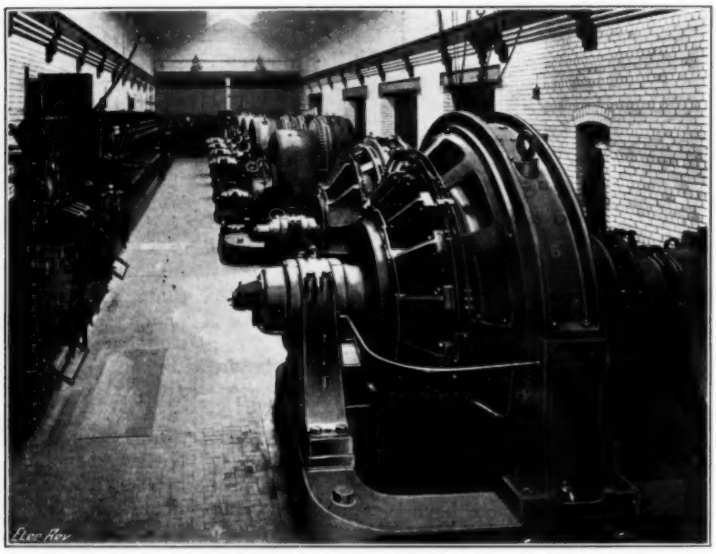


Fig. 5.—Paradise Street Sub-station.

run in multiple to 17 converting stations, figs. 3, 5, and 7, the plant in which may be summarised as follows:—

	kW
6 100-kW motor generators	600
33 200-kW ,, ,, ...	6,600
31 500-kW ,, ,, ...	15,500
14 1,500-kW rotary converters	21,000
2 500-kW ,, ,, ...	1,000
1 300-kW mercury rectifier	300
Total	45,000

This converting plant is supplied from the 6,000-volt 3-phase, 50-period a.c. system and delivers d.c. at from 460 to 550 volts pressure for lighting and power, or

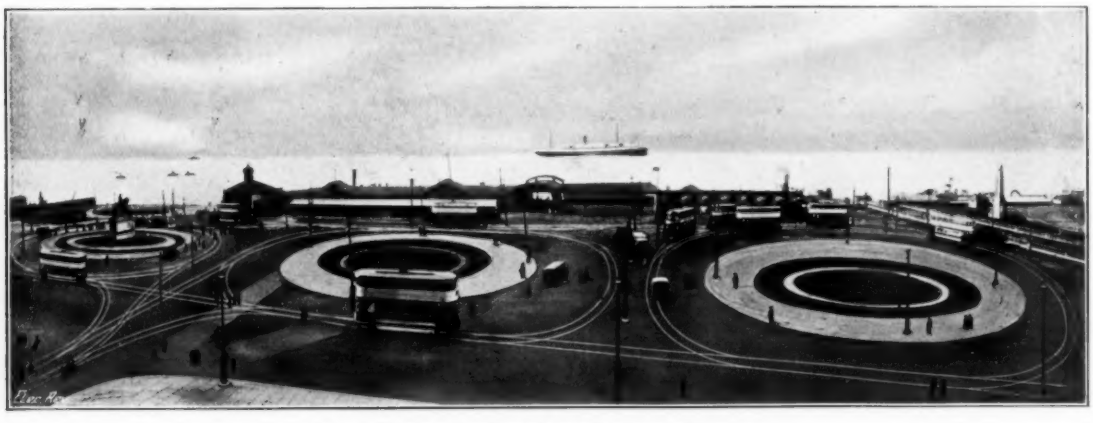


Fig. 6.—Loops at Pier Head Tramway Terminus.

tramway purposes. In addition, there are 47 static transforming stations under the control of the Electricity Department (equipped with transformers of 35,550 kVA aggregate capacity—6,000 volts to 400 and 230 volts) and 14 stations not under the Electricity Department's control (equipped with consumers' own transformers of 16,080 kVA aggregate capacity). The following special consumers are supplied in bulk:—The Mersey Docks and Harbour Board; Bootle Corporation Electricity Undertaking; and the British Insulated & Helsby Cables, Ltd.

To utilise the waste heat from the five Corporation refuse destructors, steam-driven generating plant of the high-speed direct-coupled type has been erected, and d.c. is generated and fed into the l.p. network.

Automatic rotary-converter sub-stations, connecting to the lighting network, have been installed, one of which was also officially opened on December 14th—a fact of particular interest as being the first installation of its kind in this country. Similar sub-stations are in successful operation in the U.S.A., and it is claimed that they have proved to be more reliable than manually-operated sub-stations, and that the equipment is compact and economical.

The sub-station situated at the Walton Town Hall, fig. 3, is at the centre of the d.c. distribution network, and contains one 500-kW rotary converter, but space has been left for a second set when required. All the control apparatus is mounted on five panels; they are:—(*a*) The a.c. starting and running panel; (*b*) the relay and meter panel; (*c*) the d.c. contactor panel; and (*d*) two d.c. feeder panels.

The main a.c. h.p. breaker is mounted in a cell structure; it is electrically operated and functions automatically as a part of the automatic equipment. The converter is protected from overspeed by a device mounted on one end of the armature shaft. A motor-operated device mounted on the bedplate of the converter lifts the brushes off the commutator during the starting of the converter, and the bearings of the machine are protected from overheating by means of bearing thermostats.

The a.c. relays and contactors are operated from a small station transformer, the primary of which is connected on the line side of the oil circuit breaker. The d.c. contactors are operated from the d.c. voltage of the converter and the d.c. feeder contactors, normally closed at all times, are energised from the lighting circuits.

The following features of the equipment are worthy of note:—(1) It is purely automatic. (2) It does not need any pilot wires for distant control. (3) It is started up when the demand for d.c. power justifies the machine operating; this is effected by the d.c. voltage of the network falling to a predetermined value. The station is shut down when the demand on the system is such that the output of the machine drops to a predetermined value, but a time delay relay prevents the station shutting down until a pre-arranged period after the load has dropped to the correct value; this prevents the shutting down of the machine on a momentary reduction of load.

The machine is started by means of a series of low-voltage relays; if the network voltage falls below a predetermined figure a connection is made through a time-limiting device, which delays the action of the master relay for a certain period. This is necessary to prevent temporary drops in pressure starting the gear. The master relay then puts into operation relays controlling the following sequence:—(*a*) Lifts the brushes off the commutator; (*b*) closes h.p. switch which puts pressure on to the rotary transformer; (*c*) closes l.p., a.c., contactors on half voltage of transformer; (*d*) rotary runs up to speed; (*e*) polarity of d.c. is checked; if correct, sequence carries on; if not, polarity is corrected by field-reversing relay; (*f*) closes l.p., a.c., contactors on to full pressure of transformers; (*g*) lowers the brushes on to commutator; (*h*) d.c. contactors make circuit to d.c. bus-bars through resistances which limit the current that can pass; if this current is not excessive, contactors cut out limiting resistances and put rotary directly on to the bars; (*k*) d.c. contactors on feeders close.

Should the various relays installed for taking care of overloads on the d.c. feeders, excessive loads on the rotary, &c., or thermostats in the bearings operate, the plant is shut down and all the automatic gear locked out, so that an inspector must ascertain the trouble and reset the relay before the plant can again operate.

To shut down the plant automatically there is an underload relay, which operates if the outgoing current falls to a predetermined minimum and remains there for a given period, which is adjustable between about three and twenty minutes.

The whole of the automatic equipment has been supplied by the Metropolitan-Vickers Electrical Co., Ltd.

The underground distributing mains are, for the most part, laid according to the Callender solid system. The joint boxes fixed beneath the pavement are filled with heavy insulating oil.

The amount of energy sold during 1921 was 88,188,415 kWh, of which 26,413,265 kWh was for traction purposes.

The capital expenditure of the undertaking up to December 31st, 1921, was £3,092,134, and the total income for 1921 was £995,988. The total connections to the supply mains, excluding the tramways, are equivalent to 81,382 kW, the h.p. of motors connected being 66,674, and the number of consumers 23,202.

The Corporation took over the horse system from the Liverpool United Tramways and Omnibus Co. in 1897. The first section of the overhead trolley electric system was opened in November, 1898, and consisted of about 61¾ miles double, and 9½ miles single track. The majority of the routes radiate in fan-like formation from the Pier Head, fig. 6. The record number of passengers carried in any one year is 220,219,091. The standard electric cars are fitted with two 40-h.p. motors, and the latest type with roller bearings. The tramcars are built and maintained at the Lambeth Road works, and new works are to be erected at Edge Lane.

Where the width of the roadway allows, the track is laid on sleepers in the centre of the roadway, and no other traffic is allowed to use this portion of the road. At the dead-end termini the trolleys are reversed without leaving the wires.

Since the inauguration of the undertaking, £1,016,662 has been paid in rates and taxes, whilst £1,062,899 has been contributed towards the relief of the city rates.

Fig. 7 is a plan showing the tramway and motor-omnibus routes, together with the positions of electricity stations, tramway depôts, &c. In conclusion, we have to express our indebtedness to Mr. H. Dickinson, M.I.E.E., &c., city electrical engineer, for providing the details and photographs reproduced above.

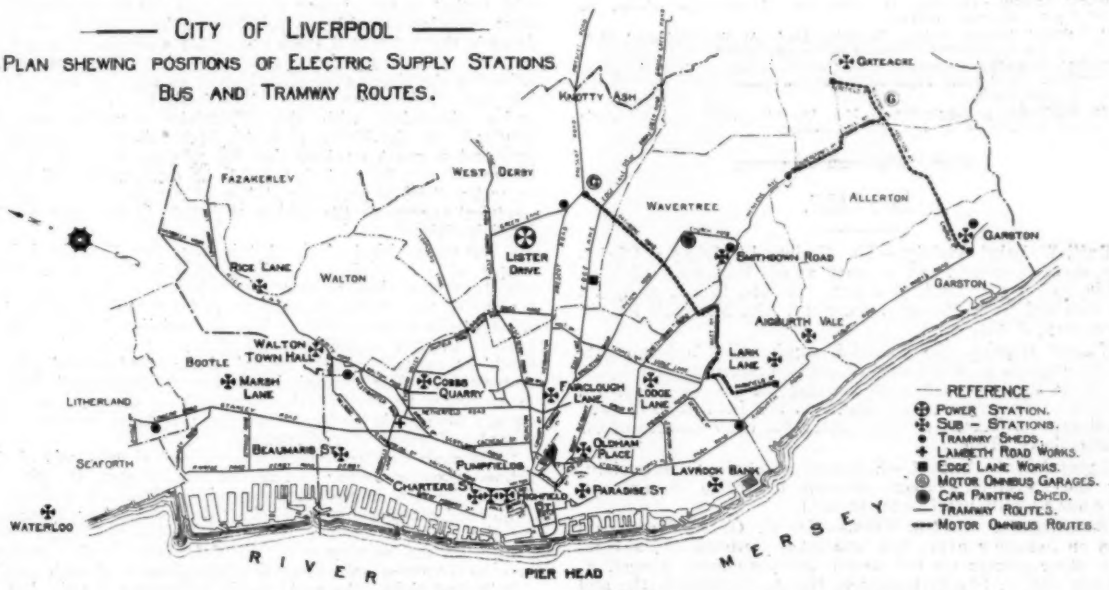


Fig. 7.—Map of Generating and Sub-stations, Tramway Routes, &c.

New Stobie Steel Furnaces.—An interesting new steel-making process has been put into successful operation at the works of Messrs. Edgar Allen & Co., Ltd., Sheffield, which promises a great revolution in electric steel-melting in the near future. The Stobie Steel Co. has installed in those works one 10-ton and one 3½-ton Stobie electric steel-melting furnaces, which are being worked together as a single unit under the Stobie patent duplex electric process. By this means, scrap steel is electrically melted and refined by oxidation in a continuous manner in the large primary furnace, and a third or more of the molten bath is transferred down a shoot at short intervals to the small secondary furnace for finishing. The advantages of the process are both electrical and metallurgical: Electrically, the load factor is greatly increased by the continuous working, and the power factor is much improved by the maintenance of, mainly, molten baths. Fluctuations of current are also less marked and of shorter duration. Metallurgically, the main advantage is the frequent supplies of small quantities of steel, of varying compositions if required, at the low cost of operating plant of large output. For ingots or foundry work this advance in practice is of considerable interest. Additional advantages of the new process over an installation of several furnaces working independently include the smaller space occupied by the plant; the reduced crane service required; the much reduced repairs to furnace linings for a given output of steel, and the freer choice of scrap for melting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of manufacturers or suppliers of :—

"CANADIAN" grinder for use in the tool-post of a lathe.
GOULD'S patent hingebelt fastener.
"SIMPLICITAS" switch.
"INVENTA" fire.
"JEERVARD" or "GEERVARD" lighting set.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—Informal meeting. Monday, December 18th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Time Switches," to be opened by Mr. E. E. Sharp.

(Sheffield and District Sub-Centre).—Wednesday, December 20th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000/150,000 V," by Major A. M. Taylor.

Institution of Civil Engineers.—Tuesday, December 19th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Extensions at Tilbury Dock, 1912-17," by Mr. F. M. G. Du-Plat Taylor.
Saturday, December 16th. Students' visit to the Greenwich power station of the L.C.C. Tramways.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, December 19th. At Rankine Hall, Glasgow. At 7.30 p.m. Ordinary meeting.

Chemical Society.—Thursday, December 21st. At Burlington House, W. At 8 p.m. Ordinary meeting.

Batti-Wallahs' Society.—Friday, December 22nd. At the Engineers' Club, W. At 8 p.m. Christmas smoking concert and re-union.

Edinburgh Electrical Society.—Friday, December 22nd. At the Philosophical Institute. At 8 p.m. Paper on "Common Telephone Faults," by Mr. G. E. Mackintosh.

Junior Institution of Engineers.—Friday, December 22nd. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

NOTES.

Batti-Wallahs' Society.—The Society is giving a Christmas smoking concert and re-union at the Engineers' Club on Friday, December 22nd, at 8 p.m. Tickets, 2s. 6d. each, can be obtained from the hon. secretary, Mr. M. Whitgift, 34, Broadway, S.W.1.

Therm Inquiry.—The official inquiry that is being held at the request of the London County Council by the Board of Trade into the system of charging for gas by the therm instead of by volume, commenced at the Institution of Civil Engineers on December 12th, under the chairmanship of Sir Clarendon G. Hyde.

Appointment Vacant.—Sub-station engineer attendant, for the Hackney Borough Council electricity department. (See our advertisement pages to-day.)

Birmingham Electric Club.—Mr. C. G. A. Macdonald was on Saturday night last, appointed president of the club. The other officers elected were: vice-presidents, Messrs. F. Unwin and P. Shaw; treasurer, Mr. A. Cunningworth; and secretary, Mr. T. Birkett. It was reported that the progress of the club had been well maintained during the year, and that there was in hand a satisfactory balance.

The British Empire Exhibition Inquiry.—Sir William Joynson-Hicks, Bart., M.P., who is making an inquiry on behalf of His Majesty's Government into certain aspects of the British Empire Exhibition, held a meeting on Tuesday, at the Board of Trade, with representatives of the Executive Council, the Management Committee, and the general management of the Exhibition, together with the High Commissioners for the Dominions and India. At this meeting, plans were made as to the procedure to be adopted in connection with the inquiry, which will now proceed immediately. The terms of reference governing the inquiry are as follows:—

To inquire into the following questions in connection with the British Empire Exhibition:—

(1) What steps are being taken to provide for full consultation with representatives of the Dominions and the Colonies in order to secure the use of Imperial produce in connection with the exhibition.
(2) The granting of concessions for entertainments and amusements.
(3) The criticisms of certain members of the Publicity Committee as to the limited opportunities afforded to that Committee to assist in the publicity work of the exhibition;

and to report thereon to the Colonial Office, the India Office, and the Board of Trade and to the Executive Council, and also in this connection to consider and recommend whether any further steps can usefully be taken to strengthen the control of the Executive Council over the general conduct and administration of the exhibition. Sir William Joynson-Hicks will be prepared to receive communications from any organisations or individuals who may desire to give evidence. Mr. R. W. Dalton, His Majesty's Trade Commissioner in New Zealand, who, as already stated in the REVIEW, is now in this country and will shortly proceed to Canada as His Majesty's Senior Trade Commissioner, will act as secretary, and communications in connection with the inquiry should be addressed to him at the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Mr. John F. P. Rawlinson, K.C., M.P., has agreed to advise Sir William Joynson-Hicks with regard to any legal questions which may arise out of the investigation.

Accident.—Whilst engaged in work on an electric feeder at North Brook Works, Keighley, on December 10th, Ralph Inman, an employé of the Corporation Electricity Department, received a shock and was rendered unconscious. The line on which he had been working all the morning had been "dead," but by some means still to be explained it became "alive" unexpectedly. Inman's hands and feet were badly burned, but at the hospital he regained consciousness.

The Electricity Supply Act, 1922 (South Africa).—At the recent Conference of Municipal Electrical Engineers (South Africa) Mr. T. C. Wolley Dod (City Electrical Engineer, Pretoria) read a paper and led the discussion on "The Electricity Act, 1922, Union of South Africa." The paper was not an exhaustive review of the Act, which now took precedence of the Provincial Laws and Ordinances, except where these were not over-ruled. After pointing out that the Act established two distinct bodies, which were responsible for its administration—an Electricity Supply Commission and a Board of Control—the author contended that in practice it would be found that the Commission had actually a monopoly with regard to new power stations. As far as practicable it must carry on at neither a profit nor a loss, and it was laid down in the Act that if there was either a surplus or a deficit on any year's working, allowance should be made in adjusting the charges for electricity to be supplied the following year. The author said: "It is futile to compare the Act under discussion with the Electricity (Supply) Act in England. In the Union of South Africa there is so small a past and so great a future that we may say that it is the future and not the past that has to be dealt with. With one exception there is no power station of any importance selling electrical energy in the Union of South Africa except the municipalities.

"The main object of the Act is to ensure that the future supply will be developed in the general interest of the community, rather than to meet the expediency of the moment for one section of the community, and I submit that the Act substantially ensures this. The Commission will be in a position to raise capital at rates of interest below those that would be expected on the capital of the less-favoured private undertaker. The Commission is not a Government department, bound by Civil Service rules and red tape, but is in an equally favourable position with the private undertaker with regard to freedom of employment.

"Although the Commission has a practical monopoly of the future large generating stations in the Union it will be difficult for it to abuse that monopoly. Clause 49, which had frightened many people, stated: 'It shall not be necessary for the plaintiff to prove that the damage or injury was caused by the negligence of the defendant,' and 'damages may be recovered notwithstanding the absence of such proof.'

"At first sight," he said, "this looks very drastic, but if we are careful not to read into this clause more than it states, and if we realise that the defendant still maintains all rights that he is not specifically deprived of, we must realise that it is competent for the defendant to plead that he was not negligent. The clause only shifts the onus from the plaintiff to the defendant."

Mr. W. C. Gardener, ex-Mayor of Cape Town, who had taken a prominent part in connection with the Act, was glad to hear Mr. Dod's observations regarding Clause 49, as that was a matter which had caused some anxiety. They had all, more or less, got the idea that, according to the terms of the clause, it was not necessary for a plaintiff to prove anything in order to succeed. In the light of Mr. Dod's remarks, he thought the clause was satisfactory.—*Cape Times.*

The Electrical Trades Benevolent Institution.—Mr. F. B. O. Hawes, hon. secretary of the E.T.B.I., informs us that the Institution, prior to the last annual festival, had an invested fund of £18,717; in connection with the annual festival the sum of £831 was collected. Adding the available uninvested income in hand to this sum, the amount which can be invested before the end of the year is £1,100, which will bring the invested funds up to £19,817. "We felt confident," says Mr. Hawes, "that we should this year attain the milestone of £20,000, but as it will be seen from the above, we still need just under £200 to get to this point. I have had a promise from six gentlemen that if I can obtain this sum before the end of the year they will each contribute towards it the sum of £5. May I appeal to your readers to assist me to secure this gift by helping to make up this comparatively small amount now required?

"Should any of your readers hold the view, which I have heard expressed, that this Institution is building up an unnecessarily large invested fund, may I cite as an example another benevolent institution, which has existed for nearly sixty years, and gives help to persons in a somewhat similar walk of life to those whom we exist to help. That institution possesses invested funds exceeding £100,000, and yet the demand on its funds in the year 1921 exceeded the total

income. I have no doubt that when this Institution reaches the same age the demands for assistance will be greater than those on the fund to which I have just referred."

We cordially commend this most worthy Institution to the attention of our readers, for there is no question but that the fund is far too small to fulfil the objects for which it was established.

Aire and Calder Electricity District.—Sir John Snell (chairman) and Mr. Archibald Page (of the Electricity Commission) attended a conference at Bradford Town Hall on Friday last, of representatives of the municipal authorities in the Aire and Calder Electricity District, to consider proposals in connection with the matter of co-ordination and development of electrcity supplies in those portions of the West Rding of Yorkshire covered by the inquiry held at Leeds in May, 1921. The chair was occupied at the meeting by Alderman Wilfred Turner, Deputy Lord Mayor of Bradford and Chairman of the Bradford Electricity Committee. As a result of the consultations, it is stated, the Commissioners hope to secure a basis common to all parties concerned. The conference was adjourned. Negotiations are to be resumed at an early date not yet fixed. For the Aire and Calder District, it will be remembered, there were submitted at the Leeds inquiry last year three alternative schemes by a consnsus of local authorities, led by Bradford Corporation, and known as the Conference Scheme; by Leeds Corporation; and by the Yorkshire Electric Power Co.

Electric Heating in South Africa.—At the recent Conference of Municipal Electrical Engineers (South Africa) an interesting paper on "Supply of Current for Electric Heating from Central Stations" was read by Mr. John Roberts, Borough Electrical Engineer of Durban, and member of the Council of the Association. The lecturer reviewed the present position of electrical development in South Africa, and gave convincing reasons why electric heating should be used extensively, pointing out its general advantages. Mr. Roberts contended that the supply of electricity for domestic purposes, including heating, to every consumer, was a practical proposition. There was a disposition among certain electricity supply engineers, he said, to discourage attempts to give electrical service in the home, and it was feared that the electricity needed could not be supplied at rates low enough to encourage people to adopt electric stoves.

Mr. Roberts demonstrated that electricity could be supplied to compete with any other form of heating, including gas. The efficiency of gas and electric heating on a calorific basis was compared, and the cost of the necessary electrical plant to supply every domestic consumer with heat was gone into. The lecturer worked out the cost of distribution for the case of an actual Durban residential area of about 63 acres, comprising 234 consumers. The maximum demand and consumption were calculated from recording ammeter charts of twelve firemen's quarters, in which electric cooking had been exclusively used for some years, and the system of transmitting and distributing the heavy load demanded was fully described. The cost, including capital charges, of supplying 15,000 consumers with electric heat was then determined, together with the revenue derived at present rates in Durban. The capital cost was found to be £1,080,000. Revenue was estimated at £237,800; cost of production, £215,700; and profit, £22,000. A number of charts taken from a recording ammeter of actual consumption were shown, also charts showing the system of transmission and distribution, as well as photographs of various forms of sub-stations.

Mr. J. M. Clark, of Johannesburg, stated that there was a great deal of domestic stupidity in connection with the use of electricity, greater than in the case of gas, and in this respect the work of the electrical engineer was to some extent handicapped.

Mr. F. T. Stokes, Chief Assistant Engineer, Electricity Supply Department, Johannesburg, stated that in Johannesburg they had 26,000 electricity and 600 gas consumers, but notwithstanding this statistical disparity, the town was proposing to spend £750,000 on new gasworks.—*Cape Times.*

Educational.—Royal Technical College, Glasgow.—The annual report, covering the 126th session, has been published. It is stated that the record of the year is again one of pressure and difficulty. The Governors have again been continually occupied in meeting increasing demands from limited resources, but owing to the co-operation of the staff, the work of the college has been maintained at the accustomed standard.

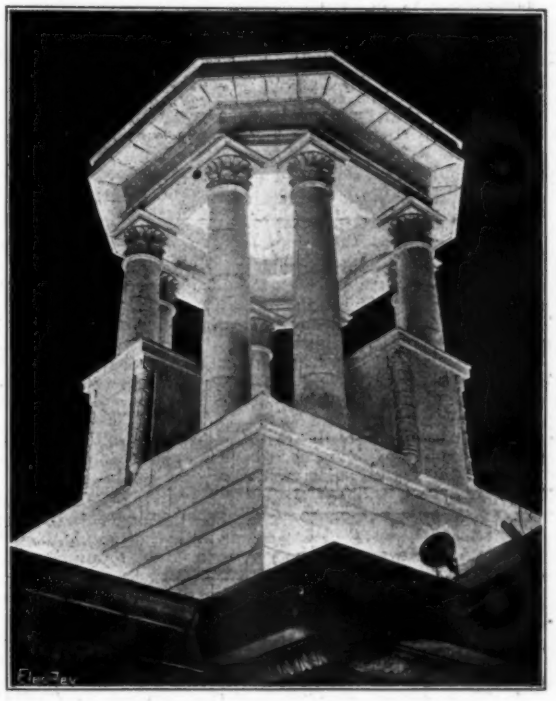
A Reversing Turbine.—Dr. T. M'C. Adair, of Belfast, has recently been considering the harnessing of the deep and narrow strait which connects Strangford Lough with the Irish Sea, and for this purpose has designed a turbo-generator set fitted with an automatic rudder which is intended to cause the set to swing round when the direction of the water current changes, to keep the turbine head-on to the flow. The turbine would appear from a correspondent's description to be a simple propeller device, and like so many previous inventions a model worked perfectly. It is hoped to utilise the power for "industries on the spot" or transmit it to Belfast. It is a pity that the Belfast station has been extended at so great an expense, but it will probably continue running in spite of the proposed development.

Radio-Control.—A new method of obtaining aerial photographs, in which the hand of the operator is replaced by radio-control, is being experimented with by the United States Army Air Service. A small kite-balloon carries up with it a camera controlled by an operator at a switchboard on the ground. Not only can the camera be made to take pictures of what lies directly beneath it, but the operator on the ground can turn the camera in any direction desired.—*Daily Mail.*

Electricity in Steel Works.—A paper dealing with the use of electricity in steel works was read on December 1st at a meeting in Glasgow of the West of Scotland Iron and Steel Institute by Mr. William MacFarlane, electrical engineer at the Mossend Steel Works. The lecturer referred to the possibilities of effecting considerable economies in the utilisation of electricity in steel-making. While they had not yet the superstations which were to produce cheap and abundant supplies of electricity for industrial purposes, the steel works, with the enormous quantities of waste heat and exhaust steam at their command, could utilise these to produce electrical energy for their own purposes cheaper than it was possible to obtain supplies from even a large power station like that of Glasgow Corporation at Dalmarnock.

South African Municipal Electrical Engineers' Conference.—The Annual Conference of Municipal Electrical Engineers and delegates was recently held in Cape Town. Mr. G. H. Swingler (City Electrical Engineer, Cape Town) was elected president for the ensuing year, and Mr. H. A. Eastman (of the Cape Town Corporation electrical staff) hon. secretary and treasurer.

An Example of Floodlighting.—Holophane, Ltd., has sent us a photograph, reproduced herewith, of an excellent example of flood-lighting which has recently been carried out at the Ilford Super Cinema. The superstructure is illuminated by three 100-W "Holophane" projectors on each side, giving an average intensity of 6 foot-candles. The interior reflector is of prismatic construction, and is housed in a spun-copper casing, the whole being equipped with adjustable brackets and special fixing arrangements for the lamp. The scheme was planned in conjunction with the consulting electrical engineer, Mr. H. W. Sutton. The installation was carried out by Messrs. Harrison Bros., Middlesbrough.



A "Holophane" Flood-lighting Installation.

Electricity from the Winds.—A scheme to harness the winds and make them produce cheap electricity for rural districts is being considered by the Ministry of Agriculture. Investigations are to be carried out to see how much electrical power can be obtained in this manner.—*Daily Express.*

Damages for Telephone Inefficiency.—A Minneapolis attorney, Mr. George S. Grimes, has secured a verdict for £210 from a jury for damages sustained by an inefficient telephone service. He sued for £630 for time lost between 1917 and 1920 through getting the wrong numbers, waiting for the exchange, and answering calls not intended for him. The North-Western Bell Telephone Co., U.S.A., is appealing against the verdict on the grounds that it is not liable for damages when it gives as good a service as it can in the circumstances. Mr. Grimes says: "At least 20,000 business men of Minneapolis, I am sure, have as good cases as mine against the company."—*Daily Mail.*

Society of Technical Engineers.—Mr. Norman Wyld, director of the Society, in addressing a meeting of the Bristol branch on December 1st, remarked that the more the future of the Society was considered the more important did its work appear to be. Its functions were threefold. First, to contribute to the better understanding on the part of the governing bodies of this country of the limitless importance of the applications of science to industry. Secondly, to obtain such an improvement in the conditions under which that kind of work was carried on as would make it more efficient. And, thirdly, to create some machinery for the relations between organised administrative and technical workers and organised employers on the one hand, and organised manual workers on the other hand, such as would lead to a fuller appreciation by each group of the work of the other groups, and thus promote smoother working, greater efficiency, and greater prosperity. Their immediate business, however, was to strengthen their own organisation, so that it would be more fully representative of the technical and administrative staffs in engineering. With that end in view they must provide definite benefits for their own members. As a first step in that direction they should all combine to put into thorough working order the unemployment insurance scheme for technical engineers which had recently been started. They should also do their best to make the Employment Bureau effective, so that not only the member seeking a post, but the firm seeking an official, would be aided. Each branch council should make it its business to get every member of the branch to join in the unemployment insurance scheme, and to make a thorough investigation, for the information of their own national executive, of the circumstances which were specially characteristic of the conditions in its area.

A general meeting of the Stretford branch was held on December 7th. Following the election of officers for the ensuing year, an address was given by the chairman of the executive council (Mr. L. H. A. Carr) on the work accomplished by the Society, with particular reference to the past year's working. In this address reference was made to the improvements in conditions and terms of employment which had resulted in the past, both directly and indirectly, from the Society's activities. The speaker also described the steps which had been taken in connection with the second group of the Society's objects, namely, those covering the advancement of the British engineering industries, and pointed out that this group of objects could not be entirely dissociated from the objects connected with the advancement of the individual, since a sound, healthy industry was essential if the status, salary and position of the technical engineer were to be improved to the requisite level.

The address was followed by a discussion on the immediate steps in front of the Society, many useful suggestions being made by members present.

In the course of this discussion Dr. Hankey (chairman of the Manchester branch of the British Association of Chemists), who was present by invitation, gave a brief outline of the activities of his society. He emphasised the similarity of the two organisations, and expressed the hope that some closer co-operation between the two bodies would be possible.

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the ordinary meeting on December 7th, the President read a letter from Col. Crompton, who has recently returned from the meeting of the International Electrotechnical Commission, referring to the good work performed by Sir Richard Glazebrook and Mr. Roger T. Smith at that meeting. The President then introduced Dr. Fleming, who was recently elected an honorary member of the Institution, and Dr. Fleming, in acknowledging his appreciation of the distinction conferred upon him, said that he had been an ordinary member for 40 years—ever since the infancy of electrical engineering. He expressed the hope that conditions would return in which electrical engineers could progress with greater ease.

INFORMAL MEETINGS SECTION.—At the meeting of the Informal Section of the Institution on December 4th, Mr. F. A. Sclater opened a discussion on "An Electric Installation at a Model Farm," and described plant he had installed some two years ago in the dairy farming quarters of a large estate in the South of England. His lantern slides showed the scrupulous cleanliness of the milking and feeding barns with paved and covered approaches, the absence of mud, usually associated with farms, and the studied convenience of the lighting with its 2-way controls. Notable, too, was an ingenious and rapid self-starting device (Sclater's patent) for the 17-h.p. engine—by motoring the generator from the storage battery and drawing to the engine waste heat from the regulator coils.

Mr. R. Borlase Matthews congratulated Mr. Sclater on his success, but criticised the farm as being a model and not a commercial farm. He said the careful lighting of the milking barns could be justified as good business, for he had found good light could be got for nothing—paid for by milk formerly spilt. He also showed lantern views and described many applications of electricity to the farm. The German Government was so alive to the importance of this subject that South German farmers had been notified that they must avail themselves of electrical methods within the next three years or vacate their farms. He also announced that the British authorities had just agreed to broadcast weather reports by wireless telephone instead of the ten words a minute Morse system now employed.

Mr. J. F. Avila was in the chair, and 19 members took part in the discussion.

On Monday next a discussion on "Time Switches" will be opened, by Mr. E. E. Sharp.

Junior Institution of Engineers.—On Tuesday last the new president, Capt. H. Riall Sankey, C.B., &c., delivered his inaugural address at the Royal United Services Institution. Mr. C. H. Wordingham, the retiring president, occupied the chair during the first part of the proceedings.

Royal Institution.—The arrangements for the early part of next year include two lectures on "The Water Power of the Empire," by Mr. Theodore Stevens, and six lectures by Sir Ernest Rutherford on "Atomic Projectiles and their Properties."

Institution of Heating and Ventilating Engineers.—In a recent paper before the Institution, Mr. C. G. Huntley dealt with the sources and beneficial effects of ozone. He asserted that more than half of the ills from which we suffered were due to the bad effect of foul air upon the nervous system. This was so generally realised that ozone was now being generated for employment in the ventilation of offices, workshops, &c.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. T. HESKETH, manager of the Folkestone Electricity Supply Co., Ltd., has been appointed a director of the company.

Mr. L. J. Kettle (Dublin City Electrical Engineer), Mr. McKeown (Works Engineer), and other leading officials, attended a presentation to MR. WM. NOLAN by his colleagues in the Corporation electricity works on his retirement through ill-health. The gift took the form of a gold Waltham watch.

MR. JOHN L. NEWLAND, for many years the managing director of the Electrical Contracts & Maintenance Co., Ltd., has joined the board of the Synchronome Co., Ltd., and is to take an active part in its management.

It has been announced that the next to occupy the position of president of the American Institute of Electrical Engineers will be PROFESSOR HARRIS J. RYAN, of Stanford University. Professor Ryan has been prominent in electrical engineering for many years, both in the United States and abroad.

MR. G. W. ERSKINE LODER has been elected chairman of the London, Brighton & South Coast Railway Co. in succession to the late Mr. Chas. Macrae.

Swansea Corporation Electricity Committee has re-elected COL. A. SINCLAIR chairman, and Councillor G. H. COLWILL vice-chairman for the ensuing year.

At the head office of the Manx Electric Railway Co., Douglas, MR. BERTRAM KELLY, A.M.I.E.E., who recently resigned his position with that company to take up the appointment of electrical engineer to the Douglas Corporation, has been presented by the officers and staff of the Electric Railway Co. with a solid silver tea service and tray.

LORD FARINGDON has been elected deputy-chairman of the London & North-Eastern Railway Co.

From among the five candidates who were selected by the Salford Electricity Committee for the post of borough electrical engineer, Mr. S. J. WATSON, of Bury, has been unanimously chosen for recommendation to the Council. Mr. Watson has been at Bury for 26 years. The salary at Salford is to be £1,250 per annum and bonus. There were 50 applicants for the position, and the above recommendation comes before the Salford Council at its January meeting.

MR. W. FENNELL, engineer and secretary of the Northwich Electricity Supply Co., has been elected as a representative of the employers on District Council (No. 3) North-Western Area, Electricity Supply Industry, in the place of Mr. J. H. Tonge, who has resigned, being now ineligible for the position.

MR. PERCY N. EVERETT, Assoc.M.Inst.C.E., late chief Diesel engineer with Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle, has now joined the staff of Messrs. Hick, Hargreaves & Co., Ltd., of Bolton, as manager of the oil engine department of the company.

MR. H. STANLEY DEACON, whose connection with Crypselco, Ltd., of Bedford, began in 1895, when the electric lamp industry was in its infancy, has just retired from the managing directorship, but he will remain associated with the board in

an advisory capacity. Mr. Deacon's son will continue to act as sales superintendent.

With reference to the paragraph in our last issue regarding Mr. Sawtell's appointment in the South of Scotland, we are asked to state that the appointment of that gentleman was quite distinct and separate from the positions of Messrs. Lamb and Reid in the Dundee electricity department, who were not promoted to fill the vacancy caused by the resignation of Mr. Sawtell.

Obituary.—M. LOUIS PRAT.—We regret to learn from *Engineering* that M. Louis Prat, managing director of the Société des Cheminées Louis Prat (a company formed a few years ago to operate his mechanical draught patents) passed away at Paris on November 20th, aged 71 years.

COL. J. M. DENNY.—The death occurred on Saturday last of Col. John M. Denny, C.B., chairman of William Denny and Bros., shipbuilders. Col. Denny was associated with many shipbuilding, industrial and railway enterprises, and was prominently connected with some of the engineering institutions.

LIEUT. J. N. WILKINSON.—With feelings of deep regret we record the death, on December 2nd, in Springfield ex-Officers' Hospital, Knotty Ash, Liverpool, of Lieut. James Nathaniel Wilkinson (R.A.M.C.), at the early age of 39 years, after an illness extending over four months. Lieut. Wilkinson was an assistant installation engineer in the Manchester Corporation Electricity Department, joining the staff of that department so far back as 1897. A member of the R.A.M.C. (Territorials) for many years, at the outbreak of war he was called upon for service, and served with the 42nd Division throughout hostilities. His service in the Army resulted in his being a victim of malaria, which undoubtedly assisted in the undermining of his constitution, and finally he passed away with acute Bright's disease, dropsy supervening. He has left a widow and three children. The funeral, of a full military character, took place at the Southern Cemetery, Manchester, on December 7th, and was attended by many old friends and a large number of colleagues from the department.

MR. R. BONE.—The death is announced, at the age of 45 years, of Mr. Robert Bone, partner in the firm of J. E. C. Else, Ltd., electrical engineers, of Duke Street, St. Helens (Lancs.). He had been associated with the firm for 26 years, and had been a partner for about six years.

MR. ERNEST WILLIAM SHAW, electrician to Captain Gerard Leigh, at Lees Court, Faversham, met with a fatal accident on November 30th. Whilst motor-cycling he collided with a motor lorry, and died from his injuries the next day. He was 57 years of age.

MR. B. S. BROADHURST.—We regret to announce the death of Mr. B. S. Broadhurst, which occurred on Monday last. As managing director of the Brush Electrical Engineering Co., Ltd., with a total period of service in that company in various capacities extending over 40 years, Mr. Broadhurst was held in universal esteem, and to his many friends the untimely death of a man of such apparent robust constitution must come with a shock. His health had been giving anxiety for some three or four months, and unfortunately the diagnosis of a deep-seated internal growth was such as to make any successful operation impossible.

MR. A. R. MCCALLUM.—We deeply regret to record the death of Mr. A. R. McCallum, which occurred on Monday night, as the result of an accident on the railway near Chesterfield. He was visiting Sheffield and other towns in connection with the operations of the firm of C. P. Sandberg, which he joined last year.

NEW COMPANIES REGISTERED.

Pressland Electric Supplies, Ltd. (186,248).—Private company. Registered December 6th. Capital, £1,100 in 1,000 10 per cent. cumulative participating preference and 100 ordinary shares of £1 each. To enter into a contract with C. Pressland, and to carry on the business of electrical, mechanical and general engineers, technical advisers, contractors, agents and manufacturers, dealers in and suppliers of electric, magnetic, galvanic and other apparatus, &c. The permanent directors are: A. W. Matton, Broadmead, Marlborough Road, Hampton-on-Thames (director of Foot and Mouth Diseases Cure, Ltd.); C. Pressland (managing director), The Sub, Gloucester Road, Hampton-on-Thames. Remuneration: £100 each per annum. The directors shall not be entitled to receive any remuneration until the preference dividend of 10 per cent. has been paid. Registered office: Old Drill Hall, London Road, Hampton-on-Thames.

Hutchison Phonophane Co., Ltd. (186,310).—Private company. Registered December 5th. Capital, £50 in 1s. shares. To carry on the business of manufacturers, importers and exporters of and dealers in electrical and radio machinery, instruments, apparatus and supplies, &c. The first directors are: E. R. Jones, Jesmond Dene, Shepperton; H. W. Packer, 26, Cedar Road, Cricklewood, N.W.; E. H. Fallows, Norfolk, Conn., U.S.A.; R. H. Redmond, 37, The Drive Mansions, Fulham Road, S.W.6. Secretary: H. W. Packer. Registered office: Dacre House, Dean Farrar Street, Westminster, S.W.

Midland Flexible Metallic Tubing Co., Ltd. (186,177).—Private company. Registered December 4th. Capital, £25,000 in £1 shares. To carry on the business of manufacturers of and dealers in flexible metallic tubing, armourers of electric cables, wire drawers, rollers of metals, electroplaters, manufacturers of and dealers in rubber and rubber goods, engine and carriage builders, millwrights, metal workers, makers of cables in iron, steel or other metals, &c. The first directors are: G. A. Eastwood, Brambling House, Chesterfield; C. Clark, The Cedars, Newbold Road, Chesterfield; T. G. Mellors, Fern House, Mapperley Road, Nottingham. Qualification: £250. Solicitor: H. Hanson, New Square, Low Pavement, Nottingham.

Dagno, Ltd. (186,200).—Private company. Registered December 5th. Capital, £5,000 in £1 shares. To adopt an agreement with J. H. Noble; to acquire, work, manufacture or use any inventions, letters patent or like privileges relating to or which may be deemed to be of use in connection with accumulating, storing, producing, supplying or using electricity or electrical currents or force, &c. The first directors are: J. MacHarg, Poplars, The Green, Wallsend-on-Tyne; T. W. Spencer, 60, Bede Burn Road, Jarrow; J. Daglish, East Villa, The Green, Wallsend; J. H. Noble, 74, Bede Burn Road, Jarrow (all permanent, subject to holding the necessary qualifications). Qualification: £200. Remuneration (except managing director) as fixed by the company. Registered office: 14, Grey Street, Newcastle-on-Tyne.

Wholesale Wireless Co., Ltd. (186,130).—Private company. Registered December 1st. Capital, £1,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers and contractors, manufacturers of and dealers in electric lighting, power and transmission plant and wireless apparatus, &c. The first directors are: L. S. Alexander, "Durane," Ickenham Road, Ruislip, wireless instrument manufacturer; S. B. Graham, 113, King's Cross Road, W.C., solicitor. Registered office: 103, Farringdon Road, E.C.

Magniphone Co., Ltd. (186,262).—Private company. Registered December 7th. Capital, £300 in £1 shares. To carry on the business of wholesale electrical suppliers, electricians, electrical, mechanical, motor, telephone, telegraphic, heating, ventilating and general engineers, &c. The permanent directors are: A. Fontana, 58, Gordon Square, W.C., engineer; J. S. Smith, 58, Gordon Square, W.C., produce broker. Secretary: C. Hering. Registered office: 317, High Holborn, W.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Luminor Signs (British), Ltd.—Particulars filed of £100 debentures (second series) authorised November 3rd, 1921, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £75.

CITY NOTES.

Anglo-Argentine Tramways Co., Ltd.

With further reference to the proposals for the modification of the rights of the second preference shareholders, we have now received copies of circulars issued to the shareholders explaining the scheme and calling meetings of the company and of the second preference holders for Tuesday next, December 19th, at Winchester House, E.C., at which resolutions will be submitted, having for their object the cancellation of the arrears of dividend on the second preference shares. The directors, in giving the reasons which have induced them to submit these resolutions, state:—The company's annual earnings prior to 1914 enabled it to pay regularly, over and above debenture interest and other standing charges, the dividends on the two classes of preference shares, and on the ordinary share capital of £3,250,000. The last distribution on the latter was at the rate of 6¼ per cent., out of the profits of the year 1913. The prosperity of the company is largely determined by the cost of electric traction, and this in its turn is dependent on the price of fuel. In 1913 coal cost about 30s. per ton delivered in Buenos Aires. Under the company's power contract the charge for electric energy advances with the price of fuel when the latter exceeds $7.50 gold or 30s. per ton. By the end of the year 1918 the cost of energy had been increased by nearly 160 per cent. Working costs, which in 1915 were 65 per cent. of the gross receipts, mounted rapidly, and reached in 1919 about 80 per cent., fuel alone accounting for an increase in traction expenses averaging during the four years 1916-1919, £340,000 annually in excess of the charge under that heading in 1915. Hence it became impossible to meet the cumulative dividends on all the preference share capital, payments in respect of which had been continued on the first preference shares up to the half-year ended June 30th, 1917, and on the second preference shares up to the year ended December 31st, 1915.

Although, after the conclusion of peace, operating expenses, other than wages, began to decline, the burden already imposed by the abnormal circumstances resulting from the war continued to press severely on the company's revenue. Further, the company's obligations under the new pensions law absorbed in a great measure the benefits of the increased tariff sanctioned by the municipality of Buenos Aires in January, 1920, which came into effect in April of that year. Despite these facts, however, the company, by means of drastic economies and favourable rates of exchange, found itself in a position to commence paying off in that year the accumulated arrears of dividend on its preference share capital. Since then the whole of the arrears on the first preference shares, together with current dividends, amounting in all to £880,000, have been paid, whilst, on the second preference shares, the sum of £343,750 in respect of the 2½ years ended June 30th, 1918, has been paid. It is now proposed to make a further cash payment of the arrears for the six months ended December 31st, 1918, leaving £550,000, or four years' dividend, which will have accumulated on these shares by December 31st next.

In view of forthcoming necessary expenditure of a capital nature, and other obligations imposed on the company, both by the terms of its last concession and the progressive requirements of the city of Buenos Aires, such, for example, as

an increase of rolling stock to cope with the enormous growth of traffic, and the construction of nearly 20 miles of line connecting up outlying districts to meet the demands of an ever-increasing suburban population, it is deemed to be in the interests of the company that the arrears of second preference dividend, for the accumulation of which the war was largely responsible, should be disposed of, and the coming year commenced free of such liability. To enable this to be done, the Compagnie Générale de Tramways de Buenos Aires, which holds the whole of the issued ordinary shares and the majority of the issued second preference shares, has put forward proposals which, shortly stated, are that all such arrears of dividend shall be cancelled, but that the second preference shareholders shall receive the full amount of such arrears in further fully-paid second preference shares ranking *pari passu* with the existing shares, and that the dividend on the second preference shares as from January 1st, 1923, shall be increased from 5½ per cent. to 6 per cent. per annum.

As the company cannot itself issue further fully-paid preference shares in satisfaction of the arrears of dividend, the Compagnie Générale has agreed to provide such shares out of the existing ordinary shares, 110,000 of which are for this purpose to be converted into second preference shares ranking *pari passu* with the existing second preference shares and to be transferred by the Compagnie Générale without payment to the existing second preference shareholders, as at the date of the confirmation of the special resolutions. At the same time, so as to preserve as closely as possible the existing balance of voting power as between the second preference shares and the ordinary shares, the remaining 540,000 issued £5 ordinary shares and the 150,000 unissued ordinary shares are to be sub-divided and reconsolidated into 862,500 £4 ordinary shares. As the result of the above proposals, if carried out, every second preference shareholder will, in return for giving up the arrears of dividend on his shares, receive from the Compagnie Générale the full equialent of such arrears of dividend in fully-paid second preference shares, *i.e.*, 11 further shares in respect of every 50 shares now held, and in the same proportion for other holdings, and all such shares will for the future carry dividend at the increased rate of 6 per cent. per annum.

Ferranti, Ltd. The report of the directors for the year ended June 30th, 1922, which was presented at the annual meeting at Winchester House, E.C., yesterday, showed a net profit of £24,371, after making provision for general establishment charges, bad debts, repairs and renewals, interest on debenture stock, notes, and loans, and making the usual allocation to depreciation reserve, and providing for taxation. The balance standing to the credit of the profit and loss account is dealt with as follows:—Balance at June 30th, 1921, £25,730, less preference dividend for three years, paid December 30th, 1921, £9,607, leaving £16,123, plus the net profit for the year to June 30th, 1922, £24,371, leaving £40,495. £50,000 has been transferred from depreciation reserve account to general reserve account, leaving a balance of £56,912, which is considered ample, as the book figures of land, buildings, plant, and machinery are based upon independent valuations obtained in 1919. The general reserve account, after making the above transfer, now stands at £152,630. The results of the trading for the year were affected by the lock-out in the engineering trade in the spring of this year. During the year £27,500 five-year 7 per cent. notes were repaid, and the balance of £4,500 will be paid on maturity at December 31st, 1922. The directors have carefully reviewed the position and prospects of the company, and they consider that the reorganisation of the company's capital, which has been delayed for some time, should now be carried out. Full particulars of the scheme were to be considered yesterday at extraordinary general meetings following the annual meeting.

The scheme of arrangement has been framed in order to deal with the arrears of dividend on the 6 per cent. cumulative preference shares to June 30th, 1922, to provide a share bonus to the ordinary shareholders to compensate in some measure for the absence of dividends, and to increase the deferred shares to an amount more commensurate with the value of their interest in the company. It is proposed to deal with the arrears of dividend, which at June 30th, 1922, amounted to 10½ years, by the payment for five years of 30 per cent. in cash, less income tax, and for the balance of 5½ years of 33 per cent. by the distribution of one fully-paid preference share of £1, without any deduction in respect of income tax, for every three preference shares now held. The ordinary shares of £1 each are entitled to a non-cumulative dividend of 7 per cent. out of the profits earned in any year. It is proposed to change the description into 7 per cent. non-cumulative second preference shares of £1 each, and to distribute to the holders, by way of bonus, one fully-paid 7 per cent. non-cumulative preference share for each four ordinary shares now held. The deferred shares (£1 each) are entitled to all surplus profits, after payment of dividends on the preference and ordinary shares, and it is proposed to change the name into ordinary shares, and to distribute to the holders by way of bonus five fully-paid ordinary shares of £1 each for every deferred share now held. For the purpose of carrying out these proposals it will be necessary to capitalise £82,792 out of the amount standing to the credit of general reserve account, leaving an amount of £69,838 in that account. It will also be necessary to increase the authorised amount of each class of shares, and it is proposed that they should be increased to £100,000 in each case. When the scheme has been carried through, the authorised and issued capital of the company will be as follows:—

	Authorised.	Issued.
6 per cent. cumulative preference shares of £1 each ...	£100,000	£71,166
7 per cent. non-cumulative second preference shares of £1 each	100,000	75,000
Ordinary shares of £1 each	100,000	60,000
	£300,000	£206,166

Cape Electric Tramways, Ltd. Mr. Ludwig Breitmeyer, chairman, presiding at the annual meeting on December 6th, said that the results obtained were very satisfactory. The Cape Town system had carried 1,325,844 more passengers and the Port Elizabeth system 184,485 more than in the previous year, representing a total increase of £17,446 in the receipts. Expenditure, however, had increased to a greater extent, owing to the making up of arrears of maintenance caused by the war. The expenditure in this connection during the past year had been £33,000, and there was still a considerable amount of work to be done; they expected to complete this in two years. Reductions in wages had enabled them to reduce the price of monthly tickets. As this only occurred in June last, the effect was not seen in the past year's accounts. So far as could be judged by the current year's working, there was every indication that another successful year lay before the company, and the chairman trusted that nothing would occur to prevent the maintenance of the same dividend—6 per cent.

Italian Electrical Companies. The excessive drought of the past year, compelling resort to heat-driven plant, gravely affected the balance of the *Dinamo Società Italiana Imprese Elettriche*, resulting in the distribution of only 5 per cent. on its capital of 25,000,000 lire. The new plant on the Iselle river station started working in May.

The *Società Pugliese per Esercizio Imprese Elettriche*, of Geno, closed its working year to the end of June with a balance of 29,705 lire, which was disposed of in part to cover the loss of last year, and the remainder to reserve.

The *Società Distribuzioni Elettriche Zambellini* made a net profit of 561,926 lire.

The report of the *Unione Esercizi Elettrici*, of Milan, for the year to June 30th, 1922, showed a net balance of 6,666,307 lire, from which a dividend of 13 per cent. was distributed, 303,315 lire being placed to the credit of the reserve fund. It was decided to raise the capital from 75,000,000 lire to 80,000,000 lire by the issue of 100,000 50-lire new shares.

The following companies have raised fresh capital: *Società Idroelettrica Bointea di Lecco*, from 1,000,000 to 6,000,000 lire; *Società Anonima Consorzio Idroelettrica Monte Aiona*, from 10,000,000 to 15,000,000 lire; and the *Società Lucana per Imprese Elettriche*, of Naples, from 3,500,000 to 10,500,000 lire.

The *Società Elettrica Alto Milanese*, of Busto Arsizio, realised for the year to June 30th, a balance of 247,748 lire, from which a dividend of 12 lire per share was distributed.

A dividend of 3.75 lire per share on its capital of 1,000,000 lire was distributed by the Società Elettrica del Pellino, located at Borgo Manero.

The profit balance of the *Società Mineraria Elettrica del Valdarno* (Florence) of 3,512,776 lire, after writing off the loss of the foregoing year, permitted the distribution of 6 lire per share on its 50,000,000 lire of capital.

Spanish Companies. During the past working year the *Electra de Occidente S.A.* realised a profit of 35,308 pesetas, allowing of a dividend of 4 per cent. to the shareholders, the contribution of 5,000 pesetas to the reserve, and the apportionment of sundry sums to the sinking fund account.

The results of the past year's working of *Los Tranvias de Vigo* showed increased receipts from passenger traffic, the passengers carried being 1,200,000 in excess of 1920. After making the usual allotments, a sum of 225,000 pesetas was set apart for dividends upon shares, as against 160,000 pesetas in 1920. In the past year the company has carried out the lengthening of sundry lines, and is now considering the construction of new ones to link up Vigo with Bayonne, Gondomar, and Redondela, the works to be taken in hand shortly.

The accounts of the *Sociedad anonima Aguas de la Coruna* for the year 1921 showed income 478,339 pesetas and expenditure 230,054 pesetas, leaving a balance of 246,284 pesetas, which was raised by the balance brought forward from the foregoing year and repayment of certain shares to 274,643 pesetas, divided as follows:—Reserve, 12,314 pesetas; sinking fund, 12,314; emoluments of the board, 12,314; bonus to staff, 4,925; dividend upon shares, 162,500; and taxes, 39,657; leaving 617 pesetas to be carried over. The dividend is equal to 6.50 per cent.

The report of the *Tranvias y Electricidad de Bilbao*, which is a Belgian concern and consists of a number of separate companies combined, showed, for the year 1921, net profits of 1,672,041 fr., which it was decided to dispose of as follows:—To reserve, 83,566 fr.; 4½ per cent. on the shares, 337,500 fr.; to board of management, 125,025 fr.; second dividend of 5 fr. per share, 375,000 fr.; *bonos de disfrute*, 750,000 fr.; and carried to new account, 949 fr.

The accounts of the *Electricista Toledana Compania Anonima* for 1921 showed an available balance of 128,064 pesetas, from which a dividend of 10 pesetas per share, absorbing 73,000 pesetas, was declared. As an extra measure of precaution, the sum of 35,855 pesetas was transferred to reserve.

Capital Reduced.

Greengate & Irwell Rubber Co., Ltd.—The Manchester correspondent of the *Financial Times* states that in the Lancashire Chancery Court at Manchester on Monday, assent was given to reduction of the capital of the above company, which was incorporated in December, 1919, taking over I. Frankenburg & Sons and the Irwell and Eastern Rubber Co. The capital was £800,000, divided into preference shares and ordinary shares of £1. 375,000 of each class had been issued and paid up. Losses were incurred through the depreciation of stocks and the cancellation of contracts taken over from the vendor companies and other factors attributable to the trade depression.

Had the two companies continued to carry on their business they would have been entitled to a refund of £74,000 in respect of payments made for excess profits. The original companies, however, were now defunct, having ceased to carry on operations, and the Board of Inland Revenue authorities refused to refund to the new company. The company now recognised that it was impossible to maintain the claim. If that had been known before, the capital would not have been fixed at £800,000, and the purchase price would have been less. It was intended, therefore, to make an equivalent reduction in the capital by writing down to 16s. the ordinary shares held by the shareholders in the two companies that had amalgamated.

Burmah Electric Tramways and Lighting Co., Ltd.—At the annual meeting on December 6th, the chairman (Mr. C. O. Webb) said that the working profit for the year was £16,546, as compared with £14,907 for the previous year. It had been found impossible again to pay a dividend on the ordinary shares, but the preference shareholders had received 11 per cent. for the year. This still left arrears of 30 per cent. on the preference shares, which it was hoped to pay off shortly. The value of the ordinary shares would then improve rapidly.

Fuller's United Electric Works, Ltd.—At an extraordinary general meeting held on December 6th at Winchester House, Mr. George Fuller presiding, resolutions were unanimously carried reducing the capital in accordance with the reconstruction scheme. After a further meeting on December 21st a petition for sanction to the scheme will be presented to the Court. Mr. Fuller said that there was already evidence of improved trade. Judging from the results of the last few months there was every reason to believe that they had entered upon a more successful period.

Brompton & Kensington Electricity Supply Co., Ltd.—An extraordinary general meeting is called for December 22nd to confirm resolutions for the division of each of the ordinary and preference shares of £5 into five shares of £1 each and to alter certain of the articles. A further resolution will authorise the capitalisation of £90,000 of the reserve fund and £4,740 of the depreciation fund and its distribution by the allotment of one fully-paid ordinary share for every two ordinary shares held, such bonus shares to rank for any dividend declared for 1922.—*Financier.*

Manx Electric Railway Co., Ltd.—At the annual meeting on December 6th, the Chairman (Sir W. H. Vaudrey) stated that the income for the year was £64,963—a slight increase. Out of an available balance of £13,497, the directors proposed to pay the preference dividend for 1917 and 4 per cent. on account of the 1918 preference dividend, amounting to £12,369; the balance was carried forward.

Armstrong-Whitworth Development Co.—According to the *Financial Times*, the board recommends a dividend of 6 per cent. per annum, less tax, on the preference shares for the half-year, making 6 per cent., carrying £16,675 forward. Dividend 12½ per cent., free of tax, paid on the ordinary shares.

Companies to be Struck off the Register.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

Caerphilly Electric Supply Co., Ltd.
Cylectric Cookers, Ltd.
Marlborough Electric Supply Co., Ltd.
Reineke's Wireless Telephones, Ltd.

British Thomson-Houston Co., Ltd.—The half-yearly dividend on the seven per cent. cumulative preference shares is being paid next week.

Chile Telephone Co., Ltd.—Dividend of 3s. per share, free of tax, for the half-year ended September 30th.

Manila Electric Corporation.—Dividend of 2 per cent. on the common stock for the current quarter.

Canadian General Electric Co., Ltd.—Dividend of 1½ per cent. on the common stock for the quarter.

Mackay Companies.—A dividend of 1¾ per cent. on the common stock for the quarter is announced.

American Telephone and Telegraph Co.—Quarterly dividend of $2.25 per share.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1½ per cent. on the cumulative preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The most interesting feature in the Stock Exchange markets, from the point of view of those who follow electrical companies, is the announcement made by the Anglo-Argentine Tramways Co. of its proposals for meeting arrears of dividends that have accrued on the second preference shares. The broad outlines were published here in advance, and the company's circular confirms the directors' intention, subject to the shareholders' approval, to issue new preference shares in payment of the arrears, and thereafter to raise the rate of dividend from 5½ to 6 per cent. The shares had risen sharply on announcement in advance of the details, and no further changes are marked this week. The 5 per cent. debenture stock is easier.

Trade, stretching lazy arms, and giving indications of reawakening from its post-war sleep, begins to demand capital which hitherto has lain invested, for want of better employment, in gilt-edged securities. Consequently, the tendency amongst the prices of the latter is to give way. This has its effect upon a good many of the other investment stocks. On the other hand, shares in the iron, coal, steel and allied companies are advancing. The curious part of it is, that in at least half-a-dozen cases where dividends have lately been passed, the shares now stand higher than they did before the announcements were made. The Stock Exchange market is, as usual, going in front of events. Amongst shares which have benefited (although, of course, the company continues to pay first-rate dividends), are Babcock & Wilcox. The shares have been up to 71s. 3d., and, although a slight reaction reduced the price to 70s., this still shows a rise on the week.

Amongst the manufacturing shares, Metropolitan-Vickers ordinary and preference are both a good market, while Armstrongs rose sharply. The electrical manufacturing issues have moved but little. Further rises have occurred in the shares of the home electricity supply companies. City of London, County of London, St. James and South London are 1/16 to ¼ up. New County ordinary have hardened to 5s. 3d. premium. The shares are still 5s. paid. The new preference remain unaltered at 1s. 10½d. premium.

The only shares in the list to show any dullness are London ordinary, which have gone back to 2⅞. Apparently the prospect of the company taking on the supply of current to the South-Eastern Railway, in addition to its Brighton railway contract, does not appeal particularly to those who realise the peculiar circumstances which surround big contracts of this kind. In order to make these of particular importance to an electric supply company, it is well for the latter to have very extensive private connections, for naturally enough, the profits available from supply of power to railways is cut fairly fine. It may be worth mentioning to holders of the shares that Kent Electrics are in demand, without any noticeable supply being available. If shareholders wish to get a good price for their holdings, they will probably be able to do so by giving the necessary instructions to their brokers. Shares in the preference group are also better.

The railway market itself is quiet, in spite of the close approach of the dividend season. Activity in Districts has given way to a placid state of affairs, while Metropolitans drooped to 59½. After the rise which both these stocks have enjoyed, the ordinary course is for the market to find itself with many selling limits at prices a trifle higher than the current quotations, on behalf of people who just missed getting the top figures, and who, now that the demand has slacked off, want to take advantage of the best figures reached.

Amongst cable and telegraph stocks, further improvements in West India and Panama shares are the outstanding items of interest. The ordinary at 10s., the first preference at 50s. and the seconds at 30s. show further gains, and the company's 5 per cent. debentures advanced to 80. The buying is based, as previously noticed, on the hope that, under the new scale of rates which the company has now permission to charge, a brighter era may be regarded as at hand for this unfortunate company's affairs. The Eastern group is steady, holding its recoveries of last week. Great Northerns are 5s. higher at 28½; Anglo-American deferred rose 12s. 6d. to 23¾. United River Plate Telephone, after their dramatic jump, reacted to 7½. The wireless group is very quiet, a noticeable movement being a fall to 2⅛ premium in Marconi debentures, due to selling by some of the stags who wants to realise their scrip rather than pay the call due this week.

British Columbia Electric stocks have gone back a little after their boisterous rise, and the tendency amongst foreigners is dull as a whole. Mexico Tramway 6 per cents. are a point up at 56½, and Mexican Light and Power second bonds at 81½ have also improved. But the first 5 per cent. bonds, together with the common and preferred shares, are both lower. At home, British Electric Traction ordinary

advanced to 64, attention being directed to the stock by reason of the yield which it offers the speculative investor.

Cable manufacturing shares are better. Rises have occurred in Callenders and British Insulated ordinary. The improvement in Babcock & Wilcox has already been noticed. In a quiet way, substantial business is being done in the ordinary shares of the Electric Supply Corporation, which have come up from 14s. to 16s. and may quite possibly move up to the neighbourhood of £1, following the examples set by Edmundsons and Urban. In both these last-named companies, the shares went to rubbish prices, but within the past few months, substantial recoveries have taken place, and the issues are easier to sell than they are to buy. Urban ordinary are quoted at 22s. 6d., the preference at 3¾ and the 4½ per cent. debenture stock at 70. Edmundsons ordinary stand in the neighbourhood of 39s., the first preference at 4¾, and the non-cumulative preference at 3¾, while the 4½ per cent. debenture stock is about 75. Companies of this nature have had a good deal in their favour of late, much the same factors operating to assist them as have brought about the material improvements in the shares of the electricity supply undertakings.

Reports from the United States indicate that the Americans are doing what they can to secure forward contracts for rubber deliveries, on the basis of the present improved price of 1s. 2d. per lb. for the produce. While the market in rubber shares is far from active, the strength of the list is being fortified by a considerable amount of buying on behalf of people who, in the great majority of cases, take up their shares and are prepared to keep them for the better times which appear to be coming into sight.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Dec. 12. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	10½	—	£5 17 1
Charing Cross Ordinary	8	9	7¾	—	5 16 2
do. do. do. 4½ Pref.	4½	4½	4¼	+ ⅛	5 9 1
Chelsea	6	6	6½	—	4 9 0
City of London	14	14	2⅛	+ ⅛	6 7 10
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1½	+ ⅛	5 6 8
do. do. 6 per cent. Pref.	6	6	1¾	—	5 4 4
Kensington Ordinary	9	10	7¾	—	6 7 0
London Electric	2½	4	2¾	— ⅛	4 4 3
do. do. 6 per cent. Pref.	6	6	5⅝	—	5 17 1
Metropolitan	7	7	6¾	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4¼	+ ⅛	5 9 1
St. James' and Pall Mall	12	12	9½	+ ½	6 6 4
South London	7	7	4½	+ ¼	5 18 0
South Metropolitan Pref.	7	7	1-⅛	—	5 18 0
Westminster Ordinary	10	10	7¾	—	6 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	1½	34/6	23½	+ ⅜	6 6 4
Chile Telephone	6	6	6½	—	4 16 0
Cuba Sub. Ord.	7	7	8	—	8 15 0
Eastern Extension	10	10	19½	—	5 4 0
Eastern Tel. Ord.	10	10	190½	—	5 5 0
Globe Tel. and T. Ord.	10	10	19½	—	5 4 0
do. do. Pref.	6	6	11¾	—	5 7 10
Great Northern Tel.	24	22	28½	+ ½	7 18 0
Indo-European	10	10	35½	—	7 1 0
Marconi	25	15	21	—	7 1 2
Oriental Telephone Ord.	12	12	2-⅛	—	*5 4 0
United R. Plate Tel.	8	8	7½	+ ⅛	*5 6 8
West India and Panama	Nil	Nil	10/-	+ ⅛	Nil
Western Telegraph	10	10	19⅛	—	*5 4 7
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	59½	— ½	3 15 8
do. District	Nil	1	45½	— ¾	2 4 0
Underground Electric Ordinary	Nil	Nil	2¼	— ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8¾	—	7 2 0
do. do. 2nd Pref.	Nil	5½	4⅜	—	5 19 0
do. do. 5 per cent. Deb.	5	5	81¼xd	—1	6 2 8
Brazil Tractions	Nil	Nil	48	—	8 6 8
British Columbia Elec. Rly. Pcc.	5	5	73½	—1½	6 7 5
do. do. Preferred	5	20/-	76½	—1	*6 3 6
do. do. Deferred	3	124/-	88½	—1	*6 19 4
do. do. Deb.	4½	4½	79	—1	5 7 7
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	—	6 2 8
do. 6 per cent. Bonds	Nil	Nil	55½	—	Nil
Mexican Light Common	Nil	Nil	22½	—1	Nil
do. Pref.	Nil	Nil	51½	—1	Nil
do. 1st Bonds.	Nil	5	67	—1½	7 8 2
Manufacturing Companies.					
Babcock & Wilcox	15	16	3½	+ ⅛	4 11 5
British Aluminium Ord.	10	5	16/3	—	6 3 1
British Insulated Ord.	15	15	2½	+ ⅛	6 13 4
Callenders	15	15	2⅛	+ ⅛	6 17 0
do. 6½ Pref.	6½	6½	1¼	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1¾	—	7 5 6
English Electric	8	5	15/9	+9d.	6 7 0
do. do. Pref.	6	6	18/3	—	6 10 6
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	17/0	—	5 17 8
Henley	15	15	2-⅛	—	6 11 3
do. 4½ Pref.	4½	4½	4¼	—	5 2 10
India-Rubber	10	—	11/3	— ⅛	—
Met.-Vickers Pref.	8	8	2⅞	+ ⅛	6 11 2
Siemens Ord.	10	10	1-⅛	+	—
Telegraph Con.	20	20	25½	—	*4 11 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, December 13th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	6¾d.	½d. dec.
a Ammoniac, Sal ... per ton	£62	...
a Ammonia, Muriate (large crystal) ,,	£48	...
a Bisulphide of Carbon ,,	...	...
a Borax ... ,,	£30	...
a Copper Sulphate ,,	£26 15s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ,,	7¾d.	...
a Shellac ... per cwt.	£17 15s.	5s. inc.
a Sulphur, Sublimed Flowers ,,	£9	...
a ,, Lump ,,	£9 2s. 6d.	27/6 inc.
a Soda, Chlorate ... per lb.	3½d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£100	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£168	£1 inc.
Grade II ... ,, ,,	£122	...
Grade III ... ,,	£68	...
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ,,	9¼d.	...
c Copper Tubes (solid drawn) ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£96	...
c ,, Sheet ... ,,	£96	...
c ,, Rod ... ,,	£96	...
d ,, (Electrolytic) Bars ,,	£69 10s.	5s. dec.
d ,, ,, Sheets ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£79 10s.	5s. dec.
d ,, ,, H.C. Wire per lb.	9½d.	...
f Ebonite Rod ... ,,	3/6	...
f ,, Sheet ... ,,	3/-	...
n German Silver Wire ,,	2/6	...
h Gutta-percha, fine ... ,,	12/6	...
h India-rubber, Para fine ,,	1/1½	½d. inc.
i Iron Pig (Cleveland Warrants) ... per ton	92s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£24	...
g Lead, English Pig ... ,,	£27 5s.	5s. dec.
g Mercury ... per bot.	£12 to £12 2s. 6d.	2/6 inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/1	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ,,	1/3½	...
o Platinum ... per oz.	£23	...
d Silicium Bronze Wire ... per lb.	1/0½	...
r Steel, Magnet, in bars ,,	10d.	...
m Tin, Block (English) ... per ton	£175 10s. to £176	£2 inc.
m ,, Wire, Nos. 1 to 16 ... per lb.	3/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
m P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

An American Automatic Sub-station.—An automatic sub-station at Kansas City for dealing with a high-pressure a.c. supply was recently described in the *Electrical World*. This station has two incoming 4,000-V three-phase lines, each with a transformer stepping down the pressure to 2,300 V and feeding a three-phase, four-wire circuit. During a "peak" each line, through its transformer, feeds a four-wire circuit independently of the other, but, when the load decreases, it is required to make one transformer carry the whole load and supply both four-wire circuits. This is accomplished by a contact-making ammeter on one of the lines. Upon making contact at a pre-determined low-current setting, this ammeter energises a motor driving a controller-drum. As the segments of the drum come into contact with their contact fingers, the various oil switches operate in the proper sequence, so as to transfer the group of feeders fed by the line "No. 2" to the other line, and disconnect line "No. 2" and its transformer. When the load again rises above the limit the contact-making ammeter on line "No. 1" puts another source of power into operation and reverses the operation of the oil switches. Arrangements are also made so that in case of trouble on one of the lines the groups of distribution feeders affected will be thrown over to a spare line and transformer. Each group of feeder circuits and equipment forming a three-phase group is separated by barriers from adjacent groups. Included in these groups are three feeder regulators, oil switches, the control panel, and a group of compartments fed by a spur bus-bar from the main bus-bar. In case of opening of a single-phase feeder switch it is re-closed; if it again opens it is re-closed; but if it opens a third time and will not stay in, it is locked out and line conditions are investigated.

THE POSSIBILITIES OF UNDERGROUND TRANSMISSION AT 100/150 kV.

By A. M. TAYLOR, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The object of the paper is to consider how electricity can be cheaply and efficiently transmitted over long distances in cases where the use of overhead lines at high pressures, *e.g.*, from 100,000 to 150,000 volts, are not considered advisable. If underground cables could be employed at voltages of the same order as those of overhead lines, it might be possible to obtain wayleaves along trunk railway lines over great distances, and in such a case the cost of transmission might be reduced to a figure as low even as that with overhead lines. The paper is primarily a plea for the use of single-phase cables.

The author has developed a system on the separated-phase principle, which permits of the pressure between the outermost core and earth being reduced to some 18,000 volts while still obtaining 100,000 volts for transmission, coupled with certain other advantages of moment. In what follows it is to be understood that the amount of power to be transmitted is 50,000 kW, the load factor 40 per cent., and the distance 30 miles.

It is practicable to keep the plain copper-voltage drop (*i.e.*, excluding the lead-sheath loss) over a separated-phase 100,000-volt single-core system down to 2½ per cent. of the total power, or 2.75 per cent., including lead-sheath loss. The lead-sheath loss is thus, at 50 periods, only 0.25 per cent. of the total power transmitted on a 30-mile line.

Armoured cables might be desirable on long lines laid along railways. By increasing the amount of copper by 10 per cent. the iron wire loss can probably be compensated for by the reduced copper voltage-drop, and may then be neglected. The effect of separating the cores is considered, both in its relation to easing the potential gradient and in relation to eddy currents induced in the lead sheathing.

The volume of the slice of insulation immediately contiguous to the core is of the order of 1/40th (per unit length of cable) of that at the extreme circumference, and the amount of heat developed is over 20 times, consequently the heat developed per cubic centimetre is of the order of 800 times that generated in the section at the extreme circumference. The watt loss, due to the purely ohmic insulation resistances of the different sections and the true leakage current which passes through them, follows a precisely similar law, and is, again, 800 times the heat developed per cubic centimetre.

The author is quite satisfied that the power factor, representing partly, as it does, the energy lost by dielectric hysteresis, plus the true leakage loss, must be much greater in the inner layers of insulation, which are at a much greater temperature than the outer layers; and this would still further strengthen his argument.

The greater amount of heat liberated in the sections close to the core has enormously greater difficulty in reaching the circumference of the cable, therefore any method that tends to relieve the potential gradients in the sections next to the core, even if this occur at the expense of the sections nearer to the circumference, is a very potent factor indeed in easing the situation. The author has shown the remarkable effect upon the diameter of the cable of introducing metallic intersheaths and forcing them to work at such potential differences between each consecutive pair that the maximum voltage gradient is maintained more or less constant throughout. The result is that the whole 69,200 volts are absorbed within a radius of 4-1/6 cm. Such a result can be obtained only at the expense of having continually increasing capacity currents in successive layers as we work outwards, the current being no longer constant from the centre to the circumference, and a practical arrangement for dealing with this is the use of intersheaths, and the author proposes to obviate the disadvantages of intersheaths by combining them with a 6-phase transmission system. Fig. 1 shows what takes place in a single phase of a three-phase system embodying one single-core cable per phase, each such cable having intersheaths.

The half-wave of e.m.f. in the secondary is in a downward direction through the secondary winding, "sucking" the principal or "load" current of the central core of the cable and carrying it through to the neutral point of the transformer winding. The current *f* arrives through the outermost conducting core. Finding a path leading to the tapping of the transformer, the "surplus" current of the outermost section of the insulation, instead of going through the successive layers of insulation to the central core and heating up the innermost layer in the way just described, now takes a short cut across to the tapping of the transformer. The "surplus" element of the current *e*, which has passed through the insulation from the outermost core to the intermediate core, similarly takes a short cut across to the corresponding tapping, with the result that the insulation next to the innermost core is called upon to carry only the capacity current *d* due to its own capacity. The author believes that by adopting this principle the potential gradient on the outermost layers could be raised considerably. For one reason, these layers being close to the lead sheathing, would be the coolest in the whole cable, and consequently the power factor of the dielectric would be the lowest and the restivity by far the highest, since the latter varies enormously with the temperature.

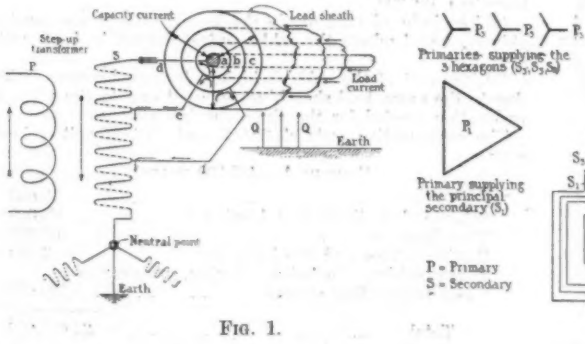
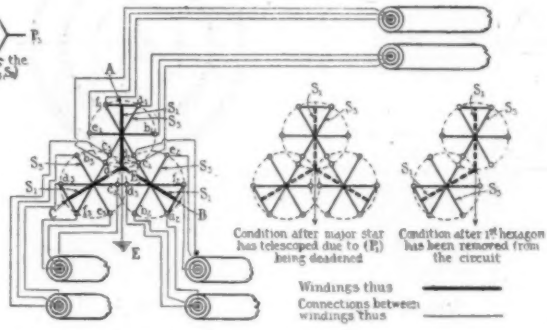


Fig. 1.


Condition after major star has telescoped due to being deadened
Condition after 1st hexagon has been removed from the circuit
Windings thus
Connections between windings thus

Sequence of Operations on Reduced Load.

(1) Oil switch of transformer r is tripped (and, if faulty, the hexagon of the faulty circuit is disconnected).
(2) Earth switch is kept from neutral point q of hexagons to earth.
(3) Hexagon No. 1 is removed.
(4) Hexagon No. 2 is removed.
(5) Hexagon No. 3 is left in.

Fig. 2.

In all probability the operation of dielectric hysteresis is very similar to that of magnetic hysteresis, and the loss (*i.e.*, the power factor where the leakage loss is low) is therefore proportional to a function of the potential gradient, and the loss by pure leakage conductance through the dielectric is proportional to the square of the potential gradient, and both of these (and particularly the latter) depend to a very great degree on the temperature obtaining in the dielectric.

Referring now to the author's six-phase/three-phase system, one—say the top—of the three small six-phase systems or "hexagons" shown in fig. 2 (which gives the general scheme) and reproduced by itself in the upper part of fig. 3, consists of a "bank" of the secondaries of a step-up transformer coupled in double star to give voltages which are in six-phase relation. This bank is connected to two cables (fig. 4) at the top of fig. 3. The lower half of the latter diagram is the inverse of the upper half. To the right are two single-phase "major" transformers, the secondary of each of which is wound for 120,000 volts and its mid point earthed. The voltage between the innermost core of each cable and the immediate core is 30,000, as is also that between the intermediate and outer cores, while the voltage between the outer core and the lead sheathing is only 17,800 volts (if desired, only 15,000).

The cable shown in section in fig. 4 has been so designed that the maximum voltage gradient on the innermost core under these voltages will not exceed about 38,000 V/cm, *i.e.*, the potential gradient at which three-phase, three-core, non-concentric cables work at the present day. On the middle and outermost cores it will be 29,000 V/cm and 20,000 V/cm respectively.

Power is transmitted both by the two six-phase systems and

by the single-phase (or equivalent) system, and reconverted at the receiving end in the form of a joint three-phase supply on to the l.p. bus-bars, so in fig. 2 the three six-phase systems each transmit power in conjunction with the "major star" system, the latter working at from 100,000 to 150,000 volts, according to whether it is decided to risk a maximum potential gradient of 60,000 V/cm (as is, the author understands, at present under contemplation with three-phase cables) or of only 40,000 V/cm.

The author has developed a simple arrangement which he thinks would be very valuable on long lines for reducing the drop due to capacity current. By the establishment of one or two sub-stations of comparatively small capacity along a long line (from which power would be supplied for commercial purposes for traction or lighting), it is quite practicable to "feed in," at the sub-stations, the capacity currents for the different insulation "rings" of the cable, and to transmit this current at the full 100,000 volts, re-transforming it to the local voltages required.

The arrangement proposed greatly reduces the amount of capacity current to be passed out from the central station through the intermediate and external cores, because we can feed into the line at as many points as may be found desirable (the maximum length to be fed varies inversely as the number of feed points) and therefore the central station has to supply only the capacity current for the said cores for the first quarter-section of line (if there is a mid-way sub-station).

The transmission system represented by the upper six-phase hexagon in fig. 3 could be started, in the first instance, by itself, having its bottom point directly earthed, and thus the initial capital expenditure would be reduced. Under these circumstances the system would operate at 60,000 volts. Later on, when the load developed, the second or lower six-phase system could be added, in such a sense that its instantaneous

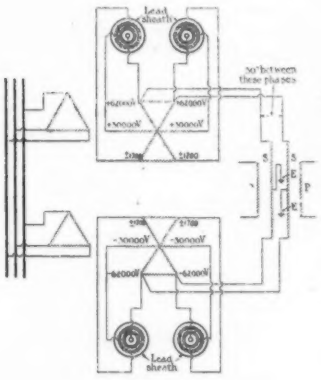


Fig. 3.

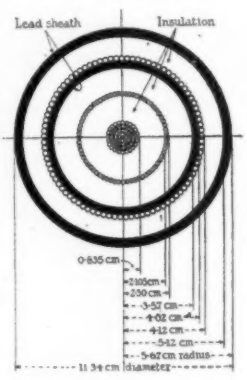


Fig. 4.

diametral e.m.f. would run upwards (on the diagram) at the same time as that of the upper hexagon. Its highest point, however, as well as that of the lowest point of the upper hexagon, being at earth potential, it would now be practicable to add a single-phase transformer and transmit over the same lines a single-phase superposed current at 123,000 volts, which could be similarly transformed at the distant end, and would considerably increase the carrying capacity of the two six-phase systems. Lastly, when the load of the system warranted it, the balance of the three-phase network, shown in fig. 2, could be added and the vector relations of the e.m.f.'s could be easily altered so that the 123,000-volt single-phase supply could be replaced by a 100,000-volt three-phase supply.

With suitable precautions to avoid "current resonance," the author believes that the necessary charging currents may be fed into the line at convenient points in such a way as to avoid passing any charging current along the central cores, thus opening up the possibility of removing the disability under which a.c. now labours as compared with d.c. transmission.

On such a line, loads having a power factor of only 0.7 would be invited, and a.c. railway electrification with single-phase motors at 25 periods might, in some cases, be employed if otherwise found desirable.

For regulation alone it appeared to be a necessity that 10 cables should be employed, on the assumption that it was undesirable to make the cables of greater sectional area than 0.25 sq. in. per core. There is, however, the alternative point of view whether the additional waste of energy involved by using only five cables would not cost more, when capitalised, than the difference in price between five cables and ten cables. In other words, it will pay to invest £58,300 in extra copper in the transmission line in order to save 1 per cent. of the total power generated.

To make it pay to put five cables in parallel instead of ten the difference in capital cost should be of the order of £653,000 plus, say, £50,000 (to £100,000) on account of induction regulators, making a total of, say, £703,000.

The system proposed offers, as compared with 3-phase, 30,000-V single cables or single-core cables, the following advantages:—

(1) The separation of the (principal) phases carries with it a much greater freedom from complete short-circuits.

(2) The virtual elimination of all faults except those to earth, and the reduction of interruptions caused by the latter to such a degree that the working of the system is not seriously affected.

(3) The penultimate lead sheath renders it possible to continue working even with a damaged cable.

(4) The double reliability offered by having two cables per (principal) phase; being approximately equivalent to one spare, and, in the case of a single-core 100,000-volt system, to two spare cables.

(5) The capacity current neutralises the lagging component of the load current (on a 30-mile line), and completely eliminates the reactance drop in the line at full load, due to this component traversing the same (the power factor of the load =0.8).

(6) The gain effected in the performance of the insulation by the use of intersheaths.

(7) The reduction in the capacity current at light loads, or when starting up.

(8) The improvement in step-up and step-down transformer and line "regulation."

(9) The improvement in the hysteresis loss at lighter loads.

(10) The limitation of initial capital outlay to the natural growth of the load.

(11) No waste space in the centre of the cable.

(12) Assuming that the line can be made self-exciting, the difficulty in connection with feeding the capacity currents to the line disappears, and very much longer transmissions can be attempted than would otherwise be practicable. In fact, the disadvantage, as compared with direct current, largely disappears, and the two appear on a substantial equality—at any rate as regards line regulation.

As compared with 30,000-volt three-core cables there are the following disadvantages:—

(1) Owing to the separation of the phases the power factor of the load is more marked on line regulation at any voltage less than 100,000.

(2) The induced currents in the lead sheathing are considerably increased where the cable centres cannot be kept within 6 or 7 in.

(3) The cost of the cable is higher, for equal copper section, due to the extra lead sheathing required and to the triple impregnation needed for the three insulations.

The comparative costs of 30,000 and 100,000-volt schemes are:—

Scheme A.—(30,000 volts).	£
Buildings	10,000
Oil switches (including bus-bars)	26,000
Transformers	60,000
Station cables and bus-bars, &c.	3,000
Trunk cables, (including laying, excavating and re-instating streets	...1,000,000
Total	£1,099,000

Scheme B.—(100,000 volts).	£
Buildings	25,000
Oil switches	30,000
"Major star" transformers	52,800
"Hexagon" transformers	60,000
Station cables, bus-bars, &c.	5,000
Trunk cables	400,000
Total	£572,800

Note.—If the sub-station load be used to feed the capacity current, the above total cost will be reduced to £535,000.

Discussion in London.

Supplementing his paper at the Institution on December 7th, Mr. Taylor said that three firms of cable manufacturers had undertaken to make, lay, and guarantee for a year cables to conform with the requirements set out in the paper.

Mr. C. P. Sparks characterised the paper as highly controversial. Transmission over long distances was becoming more frequently necessary owing to the development of water-power resources, and deposits of fuel which could not be transported economically. The author, in his comparisons, did not mention overhead transmission, but analysis would show that the advantages of the overhead system would preclude the use of underground cables. Referring to the progress of these cables, he said that the dielectric of Ferranti's 10,000-V cable in 1890 was ¼-in. thick; in 1913 the same thickness was employed in 20,000-V cables. Hysteresis losses had been halved in the last few years, and to-day 33,000-V cables, with the same thickness of dielectric, were in use. He thought that cable makers were able to make and guarantee cables for transmissions of more than 40,000-V pressure, and they were not at the end of possible developments. In his opinion armoured cables were essential. In long lines a regulator was justifiable, both from the points of view of capital and running costs.

Dr. Fleming said that in view of the coming electrification of main-line railways when h.p. underground transmission would be adopted the paper was very opportune. The important part of cables was their dielectric. The dielectric strength of air increased with its pressure; could not compressed air be used as a dielectric for long-distance lines, employing sealed copper tubes? Or would the ionisation of the air by the high pressures used finally break down the insulation? Here was a field of investigation which he would like to see some enterprising manufacturer take up.

Mr. C. J. Beaver said that the use of intersheaths was suggested in 1906 by Doctors Morris and Russell, and since then useful research in this direction had been carried out by Mr. Atkinson and other members of the Institution. The author had increased the commercial value of intersheaths by considering them as current carriers, and not merely as potential distributors. The author's demands upon cable makers, although of unusual form, were not exorbitant. With regard to impregnation, there was always a doubt as to the interior condition of a cable after treatment. The "prior" method of impregnation did away with this. The paper was impregnated before its application, and to prevent future occlusion of air it could be applied under compound. British cable makers did not accept Clark & Shanklin's limits; 50,000 V per cm. of dielectric was being employed. He hoped that he had said enough to prove that British cable makers would not stand in the way of the developments outlined.

Mr. P. V. Hunter said that British cable makers had progressed on definite and stereotyped lines with regard to the form of conductors. dielectric stresses, &c., and the result had been perfect stability. Mr. Taylor wished to break away from these traditions, but he (the speaker) could not help feeling that Mr. Taylor had not done justice to the British manufacturers. A 66,000-V, 3-core cable run at 2½ times greater current density could not be more speculative than the cable proposed by the author. The latter seemed to have given up the idea of attempting to increase the dielectric capacity and endeavoured to progress by a re-arrangement of circuits. He did not think the suggested schemes were practicable. The complication, the number of bus bars, and the amount of switching equipment would be appalling. The author had apparently been unable to usefully employ the intersheaths without using six points, otherwise he would have been content with three.

Mr. J. S. Highfield said that the paper showed once again how advantageous it would be to be able to generate, transform, and transmit direct current. He mentioned that there were in existence single-core cables working at 100,000 V with a dielectric of ¼ in. thickness. Referring to Dr. Fleming's suggestion, he said that experiments on these lines had already been carried out. With a ¼-in. conductor inside a 4-in. dia. iron tube, with air insulation at a pressure of 120 lb. per sq. in., it had been found possible to transmit energy at 60,000 V. The scheme had not been tried for more than one core in a tube. Was he not correct in stating that the author could carry out his system by the use of a 6-phase transformer and two concentric three-core cables?

Mr. P. Dunsheath criticised a number of features in the scheme outlined in the paper. He said that single-core cables had great possibilities, but they were not the most suitable in this instance. The system was not exactly novel, as his (the speaker's) firm already held a patent for a similar but simpler system. It had not been proved that a cable always broke down at the point of maximum potential; there was material for investigation in this direction. He was of the opinion that intersheaths were useful to distribute the heat of the dielectric but not to increase the potential gradient. He had found that three 3-core, 37/.090 cables would be used to carry the load specified in the paper. The speaker displayed tables showing that the use of ordinary cables involved a much smaller annual kWh loss than the author's system.

Dr. Cramp considered that the use of lead-covered single-phase cables for long-distance transmission was now a certainty. The loss in single-phase armoured cables was less than would appear from calculations. Experiments were now in progress which would show that the author, in his figures, had kept on the safe side. If small gaps were left at joints of a partial conductor or insulator carrying a capacity current there would be discharges sufficient to cause serious trouble.

Mr. Taylor, in replying to the discussion, said that although suggestions for improved methods of dealing with his load had been made the speakers had carefully avoided the question of the value of the copper in the cables. No doubt the alternative schemes could deal with the load, but at what cost? He had found that to obtain the same potential gradients and losses eight cables would be required. If Mr. Beaver could improve the cables as he stated the pressure could be put up to 130,000 V immediately. Mr. Hunter need not be alarmed about complication; rotary converters, with their numerous phases, were quite as complicated. The scheme would be very easy to carry out; the basis of it all was the keeping down of annual losses to a reasonable figure. He did not agree with Mr. Highfield that a 6-phase transformer would serve the purpose. The advantage of the hexagon arrangement was that the potential was limited to 60,000 V. The consideration behind the paper was that 1 per cent. of the power transmitted was worth £80,000 when capitalised.

NORTH-EAST MIDLANDS ELECTRICITY DISTRICT.

Resumption of Commissioners' First Inquiry.

At the Town Hall, Sheffield, on December 5th, the members of the Electricity Commission, who are inquiring into a proposal by the Sheffield Corporation for the establishment of a Joint Electricity Authority for the above-named district, resumed their sittings, which were adjourned indefinitely on October 21st.* The area proposed to be covered by the authority is roughly 1,030,000 acres, having a population of 1,320,000, and includes Sheffield, Rotherham, Chesterfield, and Doncaster, and stretches from Buxton to Scunthorpe and Matlock and Retford to Doncaster. The proposal of the Sheffield Corporation is supported by the Rotherham Corporation, but is objected to by various other interests in the area.

The case for the Lincolnshire Ironmasters' Association was put before the Commissioners by Mr. Arthur Crook, one of the managers of the Fordingham Iron & Steel Co. and of the Appleby Iron Co., Ltd., who said that the members of the association generated their own electricity from the available waste gases and waste heat. This supply would be sufficient for their requirements for many years to come, and the plant at present installed was of 24,000 kW capacity. A good deal of waste heat in the district, which was not now being utilised, could be sold to the proposed authority, but the cost of the lines and mains would be considerable.

Mr. F. Beverley, on behalf of the Ironmasters' Association of Scunthorpe, opposed the proposed scheme, first, on financial grounds. The figures given by the promoters were fallacious, and if and when the proposed Authority was set up, it would not be able to supply energy in bulk at the prices which the promoters had suggested. The suggestion that if there was such a station energy might be used by the farming community in the surrounding district, was not correct, because it would not be a paying proposition. Too much land would be lost on the headlands, and that loss would be accentuated because of the large number of dykes and ditches in Lincolnshire. Again, the promoters could not tell them where the scheme was going to benefit Scunthorpe.

Mr. W. P. Donald, on behalf of the Frodingham Urban Council, agreed with the Lincolnshire ironmasters' view of the matter. It was a case of industrial and electrical development of necessity taking place from within, and not from without. If they were included in the area, then there would be interposed a body between the Electricity Commissioners and themselves. They were able to give a cheap and abundant supply to the area themselves without having to put their proposals through the medium of another body.

Mr. F. Abady, on behalf of the Sheffield and Rotherham Manufacturers' Electrical Supply Committee, strongly supported the setting up of an efficient Joint Electricity Authority. In 1917 the manufacturers had come together on their own initiative and had asked that such an authority should be set up.

Mr. Harker, opening the case for the Derbyshire and Nottinghamshire Electric Power Co., said that no case had been made out against the company regarding failure to carry out its obligations and, therefore, it would be unfair to make the Order asked for. He submitted that the Commissioners in law could not accede to the request of the Sheffield Corporation unless they made it a condition of their order that its generating stations at Blackburn Meadows and Neepsend were transferred to the Joint Electricity Authority. Unless Sheffield was prepared to accept such a condition he submitted that in law the Order could not be made.

Mr. Bidder, on behalf of the railway companies, said that another scheme had been outlined to him, and he was anxious to know what he was to do with regard to his witnesses.

The Chairman (Sir John Snell) said that what purported to be a scheme had been submitted by the power companies the previous week. The Commissioners could not deal with that scheme, as no notification had been given of it. Plenty of time had been given the power companies to produce a scheme if they wished. It was not really a scheme, but a proposal as to representation.

Mr. Harker suggested that, in the event of the Sheffield scheme not going, on his alternative should be put forward.

On December 6th Mr. R. Harker rebutted the suggestion that the company had been asleep, and pointed out various preparations which had been made by the company to supply a greatly increased demand in the future, including an arrangement with the Yorkshire Electric Power Co. for the purchase of the Spondon station and the conversion of the Ilkeston station. The present issued capital of the company was about £371,000 and the authorised capital was £2,400,000; it had further entered into commitments to the extent of £560,000 in respect of the Spondon station and other works. He claimed that it was in the position to raise the necessary finance for its developments. The company was now controlled by the Midland Counties Co. and so far as the further expenditure, which would be necessary with respect to the present electricity district was concerned, another factor was the Power Securities Corporation, which had an authorised capital of £4,000,000. This company was ready, willing, and

*Elec. Rev., October 27th, 1922; p. 607.

able to supply its area and the whole of that area should be excluded from the control of the proposed Authority.

Mr. William Shearer, managing director of the Power Securities Corporation, said that his Board would be able without the slightest difficulty, not only to assist the Midland Counties Co. in raising money, but temporarily to put funds at the disposal of other companies pending their own issues. The price of the Spondon station was £325,000.

Witness was asked by Sir Harry Haward if he considered "the difficulty in arriving at what was the real position of the different undertakings" (the Power Co., the Midland Co., &c.,), was an advantage when they were dealing with such a public matter as the supply of electricity. The whole of the share and loan capital of the Derbyshire and Notts. Co. was owned by the Midland Counties Electrical Supply Co. and that company was not a supply company, but entirely a finance company, and made its profits out of the raising of money for different concerns.

Witness: No. It makes profits from dividends and interest it receives from the companies.

Sir Harry: Who owns the bulk of the shares of the Midland Counties Co.? The public.

Sir Harry: Are any owned by the Power Securities Corporation?

Witness: There may be 5,000, not more; a management agreements exists between Messrs. Balfour, Beatty & Co. and the Midland Counties Co, and in certain cases they manage the underlying companies. There is an independent Board of the Derbyshire & Notts. Co. and of the Midland Counties Co., &c.

Sir Harry: The independent Boards of the Derbyshire and Notts. Co., the Midlands Co., the Power Securities Corporation, and Messrs. Balfour, Beatty & Co., have to be paid for their services?

Witness: We have to live, Sir Harry.

Sir Harry: The ultimate result is that the consumer of electricity in the area of the company has to pay in one way or another for all those services?

Witness: Certainly not. The Power Securities Corporation does not get paid for any services.

Sir Harry: The impression one gets from the interworking of these companies is that there is a great deal of work to be done and paid for in connection with the supply of electricity.

Mr. J. H. W. Laverick, Vice-President of the Institute of Mining Engineers, managing director of the Tinsley Park Colliery Co., and a director of Messrs. J. & G. Wells, colliery owners, and the Renishaw Iron Works near Chesterfield, said his company (Renishaw Iron Works) had been in negotiation with the Derbyshire & Notts. Power Co. for some time for supplying it with electricity from the waste gases of the blast furnaces, through the medium of steam turbines. No orders had yet been placed for the erection of generating plant, but the two Boards of the companies concerned had each approved of the scheme going forward, *i.e.*, to form a company near Chesterfield with a capital of £50,000 to install turbines and water-tube boilers and generate electricity. The proposal was, first, to supply his own iron works and then supply collieries belonging to Messrs. J. & G. Wells. Any surplus would be sold to the Derbyshire & Notts. Co. At Renishaw they had rebuilt a blast furnace and contemplated putting down another. The original scheme was for an output of 2,000 tons of iron per week, which would have given 9,000 b.h.p. Owing to the depression in the iron trade they had to postpone the bigger scheme with regard to the generating plant, but as trade improved they hoped to go back to it.

The Town Clerk of Chesterfield said that the proposal to group Chesterfield with Doncaster for representation on the Authority was impossible.

On December 7th Mr. H. F. Bidder, representing the Derbyshire and Nottinghamshire Coal Owners' and Ironmasters' Committee, said the Cannock Chase district was a small one not electrically developed and there were no linking-up systems. The Cannock Chase Colliery Co. was at present promoting an order for itself; he would not oppose any scheme that would tend to further development, but did not believe the method put before them would assist in their development. To a Joint Advisory Board he had not the slightest objection, providing the members were properly chosen. They had been in negotiation with the power companies in order to develop electricity supply and there was a proposal which they considered was practical.

Sir Harry Haward: I thought the evidence was all the other way.

Mr. Bidder said his Association would have more confidence in dealing with the power companies about which they knew all there was to be known, which depended for their life on being run on a commercial basis, than it would if faced with a body not dependent on its being economically successful and dealing with public money. The Sheffield scheme, he suggested, was merely a panic scheme brought forward because the authority was afraid its undertaking was going to be taken over by some Joint Authority under the Act.

Mr. A. G. Lupton, of Messrs. Lupton & Co., Leeds, a director of the North-Eastern Railway Co., and chairman of the Yorkshire Electric Power Co., opposed the scheme. Any interference with the powers granted to his company would be detrimental.

Mr. William B. Woodhouse, engineer and manager of the Yorkshire Co., objected to the area in which he had powers being divided. The dividing line in that district ran through a number of collieries which his company supplied. If two parts of his areas were to come under different control the question of mains would be a difficult one, and it would very substantially discourage development across the boundary line. He had undertaken to supply 30,000 kW in the Rotherham, Doncaster, and Stockbridge districts, the power therefore being obtained either by extending his own plant or from Sheffield or Rotherham. He had been hampered by the uncertainty of what the position was going to be and could not indefinitely promise to make extensions unless he knew he was going to be permitted to develop his undertakings on the lines he proposed.

Sir John Snell: The time will come when the available sites at Sheffield, Rotherham, and near Doncaster, even including the scheme at Mexboro', may not be sufficient to meet the industrial demands of this district.

Witness: We are all agreed upon that.

The Chairman: The suggestion has been made that at some future date the district may be given to the River Trent?

Witness: Yes. The distance from the River Trent to Sheffield is about 30 miles and from Mexboro' to Ferry Bridge approximately 15 miles. The Ferry Bridge station would develop 135,000 kW.

Mr. J. B. Feltham, engineer of the Mexboro' Urban District Council, did not think there was any necessity at present for a new station at Mexboro', which site was good enough for about 90,000 kW.

Mr. R. A. Sheppard was prepared to assist in the formation of a Joint Committee, but objected to recommend the co-ordination of the various organised undertakings and the imposition of a Joint Authority for which mere establishment charges for clerks, offices, &c., a sum of £19,000 of £20,000 would be required. It was assumed that the duty of the Commissioners was to appoint a Joint Authority. It was nothing of the sort; that body had no authority to break contracts and could not promote a company to do what it could not do itself.

Sir John Snell: Our legal adviser informs me that your remedy, if you have a remedy, is in the common process of law. The Commissioners are very fully advised on the facts of the case; there is an agreement between the Sheffield Corporation and the Yorkshire Power Co., dated 1918, an agreement is to be made between the Rotherham Corporation and the Power Co., and an agreement was made at the time the Rotherham Corporation was making the Bill. We shall take these facts fully into consideration when dealing with the administration of this district.

Mr. W. B. Woodhouse, on behalf of the Electrical Distribution of Yorkshire, Ltd., submitted that the proposal for a Joint Authority should not be approved. There had been no attempt to show that the distribution could be carried on more cheaply than his company could do it.

Mr. W. Bagshaw, town clerk of Doncaster, said that nothing had ever at any time been either said or done to justify Sheffield Corporation coming to the conclusion it had with regard to Doncaster. Sheffield and Rotherham had made it perfectly clear all the way through that they intended to have 50 per cent. of the representation and the natural inference to be drawn was that those two Corporations intended to have the controlling influence over the Joint Authority. Doncaster was opposed to the scheme because it was not the most effective method of dealing with the electricity supply. The needs of the district would be better met by an Advisory Committee, and it would be more advisable to make an endeavour by voluntary co-operation to bring about the result aimed at.

The inquiry was concluded on December 8th. Sir Harry Haward was in the chair, and stated that the Greasborough U.D.C. approved of the Sheffield Corporation scheme as amended. He understood that Doncaster was in favour of some kind of an Advisory Board.

Mr. Windle: That is so.

The Chairman: An Advisory Board has to do more than give advice; it has to take certain action.

Mr. W. P. Donald, addressing the Commissioners on behalf of the West Riding District Councils Association, asked whether the promoters intended to transfer their stations to the Authority to be set up, or to rent those stations? If so, at what price? What price would the respective areas have to pay for electricity? It would require a good deal of faith to convince him that Mr. Woodhouse (Yorkshire Electric Power Co.) was prepared to hand over his plant as a free gift. The proposals which the promoters put forth for the first five years of the scheme were nothing more than the linking up and extension of existing stations. There was nothing in the proposals which could not be done by a Joint Committee. His clients preferred the Yorkshire Power Co. and the Electrical Distribution of Yorkshire. If a Joint Authority was set up, the Yorkshire Power Co. should be part and parcel of that authority.

Mr. W. E. Hart, Town Clerk of Sheffield, then summed up the case for the promoters. The real question was the interest of the consumers, and he claimed that his proposals had successfully withstood criticism. The principal objection

was with regard to the transfer, either by sale or lease, of the existing stations—at Sheffield and Rotherham especially—to the Authority. Sir John Snell had made a suggestion on the matter, and he (the Town Clerk) had lost no time in calling together the sub-committee, which was instructing him to prepare a full report on the whole question.

Up to the present the promoters had looked upon representation as vital, and felt it would be more helpful to Sheffield and Rotherham in considering the fate of their stations if they knew the general ideas arrived at by the Commissioners on the main proposals. Sheffield and Rotherham had responsibilities for supplies to some of the largest consumers in their districts, and they would hesitate if they were asked to transfer those stations to an Authority on which they had inadequate representation.

Objection had been taken to the sum of £20,000 proposed as the cost of administration; a smaller sum would have been criticised as inadequate. He did not think the £20,000 would be spent. There was reasonable ground for anticipating, before very long, a considerable demand for railway power. The colliery owners' opposition was a direct challenge to municipal administration. Sheffield and Rotherham still thought they should have a 50 per cent. representation on the Authority; an Advisory Board would not be effective in an area like that.

In closing the inquiry the Chairman said the Commissioners very much appreciated the public spirit of Sheffield in promoting the scheme, but the parties had set up a very difficult problem to unravel.

HIGH-POWER THERMIONIC VALVES.

Recent Developments.

At the Institution of Electrical Engineers on December 7th, 10-kW thermionic valves and parts, representing recent developments of the original thermionic rectifying valve made by Dr. J. A. Fleming, were exhibited on behalf of the president, Mr. F. Gill.

The valves are used for radio transmission and are of two types—namely, the rectifier (2 electrodes), and the oscillator or amplifier (3 electrodes). The difference between the two types is that in the rectifier the third electrode (the grid) is omitted. A special feature of the tubes, which are reproduced in the accompanying illustrations, is the water-cooled anode, consisting of a copper tube, which is fused to the glass bulb by means of a special copper-glass seal. This joint is perfectly gas-tight and is unaffected by the heating and cooling occurring both during manufacture and operation. When in service, the tube is mounted so that the anode is surrounded by a metal jacket through which cooling water circulates.

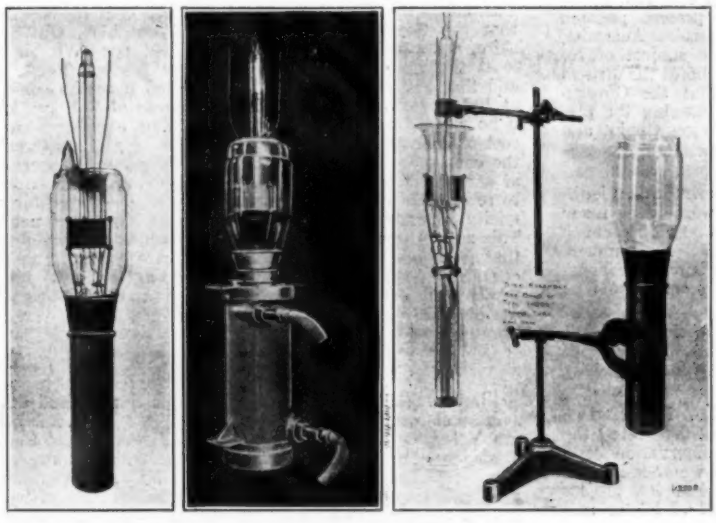


Fig. 1.—A 10-kW Thermionic Valve.

A further exhibit showed the detailed assembly of the filament, grid, and anode, the nature of the copper-glass joint upon the latter being readily seen. The above-noted features can be well seen in the reproduced photographs which show (*a*) the 3-electrode 10-kW value; (*b*) the 3-electrode tube mounted in its water jacket; and (*c*) the filament, grid, and anode before final assembly.

The following are the characteristics of the valve: Normal filament current, 24.5 amps.; normal filament voltage, 32 volts; normal plate voltage, 10,000 volts; power taken by tube (including losses in tube), 15 kW; and output power delivered from tube, 10 kW.

A new thermionic valve, which requires a 250-h.p. engine to supply it with electrical energy, is referred to in the *T. & T. Age*. It is 3 ft. long and from 4 to 6 in. in diameter, and it can be used to generate high-frequency oscillations, to detect and modulate them, and to act as an amplifier. When used to generate h.f. oscillations, it is capable of an output of fully 100 kW. It is explained that several years ago Mr. W. G. Housekeeper, of the Bell Research Laboratory of the Western Electric Co. in New York City, became interested in cheapening the manufacture of telephone switchboard lamps; he aimed to eliminate the platinum wire used for the leads to bring the filament-heating current through the glass wall of the lamp. His study showed him that copper wire possessed one of the requirements necessary, *i.e.*, that the molten glass should "wet" or adhere closely to the wire. Copper and glass have quite different coefficients of expansion, and Mr. Housekeeper found that only by giving the copper wire a peculiar cross-sectional shape could he prevent the glass cracking.

As a result of experiments, a tube design successfully involving copper seals has been worked out. The plate takes the form of a large copper thimble with thin walls. This is attached by a vacuum-tight seal to a glass structure which supports the filament and grid and through which the lead wires are carried. The filament lies within the cylindrical grid and the whole structure is placed within the copper anode and concentric with it. Cooling water is circulated around the outside of the anode, but does not enter the evacuated space within. It is, of course, necessary that the anode be very free from minute holes which would tend to admit air or water vapour, a requirement which has led to the drawing of anodes from a single disk of copper.

At present the new water-cooled tubes are being constructed in two sizes, the large one capable of delivering 100 kilowatts, and a small one whose capacity is ten kilowatts. The anode is 14 in. long and 3.5 in. in diameter. The filament is of tungsten wire and is .060 in. in diameter and 63.5 in. long. The current required to heat the filament is 91 amperes and the power consumed in it is six kilowatts. The filament leads are of copper ¼ in. in diameter, and are sealed through the glass wall by means of a special disk seal. To those who are at all familiar with glass blowing, it will be apparent that the handling of the parts of this tube during manufacture presents a task of no mean magnitude, and numerous fixtures have been devised to assist in the work. The significance of this tube development to the radio art can scarcely be overestimated.

It will be recalled that at the first all-British Wireless Exhibition in October last the Mullard Radio Valve Co., Ltd., amongst its large and representative display of thermionic valves exhibited large silica valves, including a 4-kW rectifier and 1-kW and 4-kW transmitters. Mr. C. F. Elwell, in the course of a lecture in South Africa some weeks ago, claimed that the British Admiralty was the inventor of this type of valve, silica having been chosen for its heat-resisting qualities, for which his firm had made many hundreds of such valves. They were of two types: one dissipated 2.5 kW at the anode and 5 kW in the aerial, and the other 2 kW at the anode and 8 kW in the aerial. Their 8- and 10-kW types were only 4 or 5 in. in diameter and about 12 in. long. They had succeeded in making a 25-kW silica valve, which was being tested by the Admiralty.

The claim that a million-watt vacuum tube has been developed in the General Electric Research Laboratory in Schenectady, N.Y., by Mr. J. S. Payne, Junr., should also be mentioned. It is said to be a magnetron, involving the principle of magnetic control as developed by Dr. Albert W. Hull, of the laboratory. Its output is about 40 amperes at 25,000 volts, and it serves as a rectifier to change alternating to direct current and also to change direct to alternating current of any frequency or to convert low-frequency a.c. to high frequency a.c. It is thought that one tube will be sufficient to carry radio telephonic signals across the Atlantic.

According to the *Journal of Electricity and Western Industry*, the weight of the 1,000-kW valve is only 60 lb. Its filament is a rod of tungsten, and if it were drawn out into filament of the size used in the ordinary lamp it would reach a distance of 50 miles. The light given off during the operation of the tube would be about 40,000 c.p.

This magnetron consists essentially of a water-cooled cylindrical anode 30 in. long and 1¼ in. in diameter. In the axis of the anode is a tungsten filament 0.4 in. in diameter and 22 in. long, excited by 1,800 amp. at 10,000 cycles, requiring about 20 kW. The magnetic field is produced by this large heating current from the cathode to the anode during a por-

tion of each half cycle of the current passing through the cathode, this action taking the place of that of the grid in the three-electrode tube. The electron current to the cathode is thus interrupted 20,000 times per second. By the use of properly-tuned circuits this can be used for the production of high-frequency power for radio or any other purpose. This particular type will supply 1,000 kW of 20,000-cycle power at an efficiency of 70 per cent., operating with an anode voltage of 20,000 volts d.c.

For radio purposes efficiencies of 70 and 80 per cent. are eminently satisfactory, but for other engineering purposes they are not as high as would be generally desired. Another line of development is, therefore, in progress, *viz.*, the production of tubes of higher efficiency as well as tubes of larger output. The progress in this direction is more difficult, and is apt to be slower than in the direction which has thus far seemed more important.

PARLIAMENTARY NOTES.

[By our Special Parliamentary Reporter.]

Extension of Finsbury Park Tube.—On December 5th Major Malone asked whether with a view to finding employment for a great number of men, facilities could be granted for the extension of the tube from Finsbury Park through those districts where a large population, through their district councils, were asking the Minister of Transport and the Minister of Labour to receive deputations pressing for the extension of this tube. Colonel Ashley replied that he had agreed to receive on December 11th, in conjunction with the Parliamentary Secretary to the Ministry of Labour, a deputation from the Councils concerned.

Deposits of Telephone Users.—On December 5th Mr. Short asked the Postmaster-General whether he was aware of the excessive charges claimed in the form of deposits on the accounts of users of the telephone; and whether these charges could be revised. Mr. N. Chamberlain said that the deposits required from telephone users were sufficient to cover approximately two-thirds only of the credit given. Under the previous tariff local calls were paid for in advance, usually annually, and trunk calls monthly in arrear; deposits in respect of trunk calls were generally required to cover the total credit. Even allowing for the increased deposits the subscriber received more credit under the new system than under the old, and he was not in a position to reduce the scale of deposits now required.

The Empire Wireless Chain.—On December 5th, Mr. Hurd asked the Postmaster-General to state the present position of negotiations with the governments of Canada, Australia, and the other Dominions, and India on the subject of co-operation in the imperial wireless chain scheme of the British Post Office. Mr. N. Chamberlain replied that the Government had not yet had an opportunity of considering the present situation in regard to the Imperial Wireless Chain, and he was not in a position to make any statement on the subject.

Electrical Power in Agriculture.—On December 6th, Lieut.-Col. Murray asked whether investigations were being made into the utility of windmills, with a view to providing cheap electrical power for agricultural purposes, Sir R. Sanders, Minister of Agriculture, replied that investigations were being commenced, but he feared that no definite results could be expected for some time.

Special Orders.—On December 6th, on the motion of Lieut.-Col. Ashley, Parliamentary Secretary to the Ministry of Transport, a number of Special Orders made by the Electricity (Supply) Acts, 1882 to 1922, were approved.

Damming the Severn.—On December 7th, Mr. D. Grenfell asked the Minister of Labour whether he had considered the proposal for utilising tidal energy by the construction of a barrage across the mouth of the Severn; and whether he was prepared to introduce a scheme to give effect to this project in the interests of the profitable employment of labour and capital.

Col. Ashley replied that the Water Power Resources Committee had considered the subject and had expressed the view that the technical information available was not sufficiently precise to enable it to express a final opinion. The Committee recommended that a Technical Commission should be set up by the Board of Trade, in consultation with the Ministry of Transport, to investigate the possibility from a commercial standpoint, but owing to the financial position and the necessity for drastically curtailing the expenditure of Government Departments, it had not yet been practicable to set up the proposed Commission.

Party-line Telephones.—On December 7th, Mr. Gardiner asked how many applications had been granted for party-line telephone services under the scheme entitled "Special terms to farmers and others," in England and Scotland, respectively.

Mr. N. Chamberlain said that at the beginning of this month there were 5,200 subscribers in England and 660 in Scotland.

Lerwick Wireless Station.—On December 7th, Sir Robert Hamilton asked the Postmaster-General whether he was aware that the wireless station at Lerwick was in a bad state of repair; whether it was intended to maintain this station for meteorological purposes only; and, seeing that such purposes could be equally well served by the station at Wick, would he have the station at Lerwick closed. Mr. N. Chamberlain replied that the wireless station at Lerwick was taken over from the Admiralty by the Post Office at the termination of the war in order that it might be available for maintaining communication with the mainland during interruptions of the Shetlands cable. It was subsequently transferred to the Air Ministry, who desired to use it as a meteorological station, but the right was reserved to take it over for P.O. purposes when the cable was interrupted. The purposes for which a meteorological station was required at Lerwick would not be served by a station at Wick. Repairs at the Lerwick station had recently been carried out by the Air Ministry.

Insurance by Industries.—Mr. D. G. Somerville asked the Prime Minister whether the Government intended to consider in the Session of 1923, the introduction of insurance by industries; and whether, in that case, it intended first to establish a public inquiry as to the best procedure to be adopted. Mr. Bonar Law replied: "I do not think there is any possibility of dealing with this subject next year, but it is one with regard to the examination of which preliminary steps are now being taken."

West Indian Cables.—On December 8th, Mr. N. Chamberlain, Postmaster-General, moved that the agreement dated November 29th, 1922, between the British Government, the Canadian Government, the Crown Agents for the Colonies, and the West India & Panama Telegraph Co., Ltd., be approved.

The resolution was agreed to.

Gravesend-Tilbury Tunnel.—On December 11th, Mr. William Thorne asked the Minister of Labour whether he was aware of the necessity for the construction of a tunnel under the Thames between Gravesend and Tilbury; and whether, in view of the fact that the scheme would provide useful employment both upon the construction of the tunnel and upon the building of a length of new railway, he would take whatever steps were necessary to get the scheme commenced.

Col. Ashley, Parliamentary Secretary to the Ministry of Transport, said that the question of constructing such a tunnel was one for the consideration of the railway companies and local and other bodies concerned. Statutory authority would be required for the work and he was not aware that any detailed scheme had at present been formulated.

The Beachley Power-House.—On December 11th, Mr. Wignall asked the First Commissioner of Works if he was aware that the Government power-house at Beachley, Gloucestershire, generated electricity at a cost of 2½d. per kWh, supplied it at the same figure to the Chepstow Electric Power Co., and that the latter company then retailed it to the consumer at 10d. per kWh, thereby making a profit of 7½d. per kWh; if he was aware that this company had no expenses save the cost of collecting; and if he would take steps to ensure that the consumer be supplied from the Government power-house at a much cheaper rate. Col. Ashley said he had been asked to reply. He understood that the price now charged for electricity generated at Beachley was 4d. per kWh, and not 2½d. This supply represented only a small supplementary supply to that generated by the Chepstow Company itself. The price charged by the company for lighting was the same for the whole of its area, and he understood that its operations during the last two years had resulted in a loss.

Electricity in Mines.—In reply to questions raised during a discussion upon a paper on the above subject, read before the Yorkshire Branch of the National Association of Colliery Managers, Mr. John Bentham said that generally the transmission of large horse-powers in mines by d.c. was rendered prohibitive by the size and cost of cables. Direct-current motors appeared to be more in favour with some people on account of their better starting torque and speed regulation. At the same time, the use of a.c. cascade motors had good speed regulation, and in some respects were preferable. Direct-current was preferred for tramway systems, although this often involved the conversion of a high-pressure a.c. supply. If they could keep a reasonable power factor he thought that an a.c. plant was as efficient as a d.c. system, if not better. Regarding the sizes of switchgear, Mr. Bentham said that; with a h.p. supply on the main board of the power house, it was best to standardise all the cubicle units, if possible, and generally 150/200-A sizes were quite suitable, although circumstances might necessitate larger sizes. In the case of medium-pressure supplies, say 500 V, dealing with currents up to 2,000 A, the only thing possible, if it was desired to keep one universal cubicle spare, would be to take the largest size and change the series overload coils in the switch to suit the circuit.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Holophane "Filterlite."

A new development of the "Holophane" principle of lighting is announced. This is the "Filterlite," illustrated in fig. 1, a totally-enclosed, semi-direct decorative bowl fitting in two parts. The exterior surface is smooth and plain, control of the light rays being effected by an interior prismatic construction which is designed to minimise glare and give wide distribution. The top diffuser, besides protecting the lamp and the prism surfaces from the accumulation of dust, diffuses the upward rays and eliminates the sharp

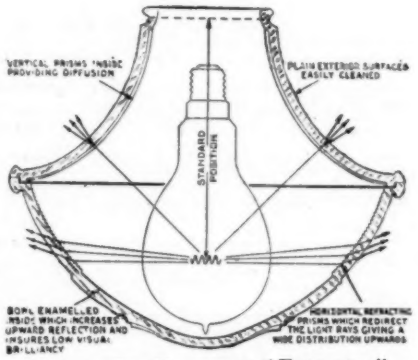

VERTICAL PRISMS INSIDE PROVIDING DIFFUSION
PLAIN EXTERIOR SURFACES EASILY CLEANED
STANDARD POSITION
BOWL ENAMELLED INSIDE WHICH INCREASES UPWARD REFLECTION AND INSURES LOW VISUAL BRILLIANCY
HORIZONTAL REFRACTING PRISMS WHICH REDIRECT THE LIGHT RAYS GIVING A WIDE DISTRIBUTION UPWARDS

Fig. 1.—The Holophane "Filterlite."

bright ring of light usually attendant upon semi-indirect fittings. The lower diffusing zone has a permanent enamelled inner surface with an ornamental exterior design which gives a pleasing effect whether the bowl is illuminated or not. The "Filterlite" should be very suitable for large rooms, offices, restaurants, &c. The makers are Holophane, Ltd., Elverton Street, Vincent Square, S.W.1.

The "Angelus" Dual-reflector Fire.

Fig. 2 illustrates the "Angelus" dual-reflector fire made by British Brass Fittings, Ltd., 26 & 27, Hatton Garden, E.C.1. It takes its description from the arrangement of the element. This consists of a number of coils mounted in a frame of nickel-plated steel, and lies horizontally in the front of the

Fig. 2.—The "Angelus" Dual-reflector Fire.

fire. Beneath the coils is a polished detachable plate which reflects the rays on to a polished coppered parabolic reflector which forms the back of the fire. The appliance is made with elements ranging from 1,500 to 3,000 W. and the larger sizes are fitted with three-heat switches. The fire is 26.5 in. high, 21 in. wide, and 12 in. deep; it weighs 17 lb.

A Battery-Charging Rectifier.

A compact form of current converter is made by Mr. M. W. Woods, 146, Bishopsgate, E.C., specially designed for battery charging. The machine (fig. 3), consists of a synchronous motor fitted with a two-part commutator which acts at such a point in the a.c. wave that sparking is practically eliminated. The rotor is excited by current rectified by the commutator, and synchronism is readily effected by closing the switch and giving the spindle a sharp twist in a clockwise direction. No other starting device is necessary. The

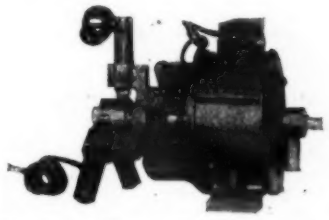


Fig. 3.—A Battery-Charging Rectifier.

rectifier is supplied with one brush for use direct from the mains, and complete with resistance, but two extra brushes and a small auto-transformer can be supplied to utilise both halves of the a.c. wave. If required a teak switchboard can be supplied, on which are mounted two cut-outs, a voltmeter, an ammeter, and two s.p. fuses, an auto-transformer, and a battery switch. The standard size is arranged to give an output of 3 A at 15 V from a 100/250 V, 50/60-cycle current.

A Burglar Alarm.

A simple and cheap device (fig. 4), has been evolved by Mr. W. S. Edwards, of 19, Smith Street, Goswell Road, E.C., for use as a burglar alarm. It consists of a couple of spring plungers of the type used in lampholders, mounted on an insulating block with the plungers in contact, the circuit being completed as usual with a bell and battery. The alarm is set

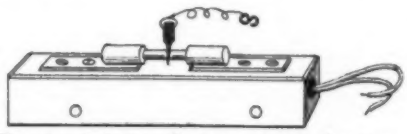


Fig. 4.—A Simple Burglar Alarm Contact.

by inserting a little insulating wedge between the two plungers, the wedge being attached by a cord and hook to any object, such as a window curtain or blind, or a door or window, which is to be guarded. Any movement of that object withdrawa the wedge and springs the alarm.

Telephone Call-box Apparatus.

The firm of Manufacturers (Liverpool), Ltd., 18 and 20, Park Lane, Liverpool, has patented a new calling and prepayment apparatus for use in call boxes. It is stated that this can be connected to any existing telephone instrument in a few minutes, and it permits the use of halfpence, pence, sixpences, and shillings. The instrument is set for a certain "originating fee," and when this has been inserted and a pointer turned to "calling exchange" on a dial, the operator replies and indicates the cost of the call. As the coins are inserted in their respective slots, and the pointer turned to another position, the operator is informed by signals that the correct amount has been paid, and makes the connection; the coins then fall into a receptacle which can only be opened by the telephone proprietors. Should the call number be engaged, or the call rendered invalid by other circumstances, the pointer can be turned in the opposite direction, and this will allow the coins to fall out of their guides through slots, and they are thus returned to the caller. Upon the replacement of the receiver all circuits are rendered inert. Means are provided by which coins inserted in the wrong slots, or that do not coincide with the dimensions for which the instrument is adjusted are returned, and the usual devices for the prevention of fraud are embodied in the design.

The Unit-Ad-Shade.

An ingenious advertising device is being introduced by the Unit-Ad-Shade Co., of 133, High Holborn, W.1, which enables small interchangeable letters to be clipped on the edge of a lamp shade, giving an illuminated message, for use in shop-windows, &c.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SKYTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C.1.

32,145. "Electric signal apparatus." A. C. Knight. November 24th.
32,149. "Windmills for driving dynamos." L. Bircher. November 24th.
32,161. "Illuminated signs." W. H. Eccles. November 24th.
32,171. "Crystal detectors for receiving wireless signals." J. V. Rushton. November 24th.
32,189. "Spark plugs." H. Fairbrother (Meaker Spark Plug Co.). November 24th.
32,206. "Galvanometers." E. Belin and Etablissements E. Belin. November 24th.
32,207. "Facsimile telegraphic systems." E. Belin and Etablissements E. Belin. November 24th.
32,208. "Transmitting and receiving graphic records by wireless signals." E. Belin and Etablissements E. Belin. November 24th.
32,218. "Systems of electric distribution." F. P. Whitaker and British Thomson-Houston Co., Ltd. November 24th.
32,223. "Radio receiving sets." A. S. Compare. November 24th.
32,228. "Electric detectors." L. T. M. Pennington. November 24th.
32,234. "Electric heating apparatus." G. L. Johansen. November 24th. (Norway, November 24th, 1921.)
32,240. "Electric lamps, &c." C. L. King. November 25th.
32,257. "Relay for automatic, &c., telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 25th.
32,258. "Automatic, &c., telephone circuits." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 25th.
32,260. "Rotor windings." Ateliers de Constructions Electriques de Charleroi. November 25th. (Belgium, November 26th, 1921.)
32,278. "Thermionic valve circuits." A. W. Long. November 25th.
32,279. "Automatic accumulator switch." W. A. Jack. November 25th.
32,298. "Aerial masts for wireless telegraphy." T. G. Murray and C. E. Shields. November 25th.
32,318. "Electric starting switches." V. Breeze and A. West & Co., Ltd. November 25th.
32,342. "Railway, tramway, and road vehicles." C. E. Holdin. November 27th.
32,358. "Lamps for motor-cars, &c." H. I. F. Evernden, W. G. Hardy, and Rolls-Royce, Ltd. November 27th.
32,363. "Fire, &c., alarm." T. W. Shaw. November 27th.
32,370. "Selective switches for telephone systems, &c." G. Deakin and Western Electric Co., Ltd. November 27th.
32,372. "Electric combination lock." L. Cadenel. November 27th.
32,373. "Galvanic batteries or electric accumulators." Anglo-American Battery Co. and T. C. Rutter. November 27th.
32,374. "Electric motor control systems." Metropolitan-Vickers Electrical Co., Ltd. November 27th. (United States, November 29th, 1921.)
32,383. "Electric switch mechanism for advertising devices, &c." E. Lancaster and F. R. Smith. November 27th.
32,384. "Apparatus for making and breaking circuit of electric horn." Eural Patents, Ltd., and H. J. Waller. November 27th.
32,394. "Contact banks for electro-mechanical telephone systems, &c." H Baron (F. Aldendorff). November 27th.
32,395. "Telegraphic receiving apparatus." Creed & Co., Ltd., and J. R. Worthington. November 27th.
32,403. "Method of protecting rectifier installations." Akt. Ges. Brown, Boveri et Cie. November 27th. (Germany, December 14th, 1921.)
32,406. "Electric safety lamps for mines, &c." R. J. Plummer. November 27th.
32,421. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. November 27th. (United States, April 5th.)
32,425. "Electric magnetos." J. Jarvis. November 27th.
32,426. "Radio signalling." R. E. H. Carpenter. November 27th.
32,439. "Automatic head-lamp control of motor vehicles." F. A. J. Green. November 28th.
32,442. "Trolleys for electric tramways." A. C. Fenwick. November 28th.
32,448. "Commutators for electric ignition systems, &c." F. W. Baker. November 28th.
32,452. "Thermionic valves, &c." E. S. Brown and G. E. Stubbs. November 28th.
32,470. "Electric batteries." G. N. Antonoff. November 28th.
32,476. "Illuminated signs for motor-omnibuses, &c." H. H. M. Shurlock. November 28th.
32,478. "Terminals for electric cells." T. W. Russell. November 28th.
32,484. "Method of securing periodic quenching in wireless receiving circuits." K. P. Hunt. November 28th.
32,492. "Radio receiving apparatus." T. L. Jones. November 28th.
32,493. "Variable resistances for grid leaks. &c." T. L. Jones. November 28th.
32,511. "Telephonic instruments." F. A. Fraser. November 28th.
32,515. "Casings for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). November 28th.
32,521. "Thermionic valves, &c." E. C. R. Marks (C. F. N. Wade). November 28th.
32,527. "Electrolysers and electrodes therefor." J. P. Scott. November 28th
32,536. "Method of electrical searching for ore." Svenska Radioaktiebolaget. November 28th. (Sweden, December 8th, 1921.)
32,544. "Illuminated advertising signs." A. J. Packham. November 28th.
32,546. "Electric coils and supporting frames therefor." Magneta Time Co., Ltd., and J. E. W. Wheatley. November 28th.
32,559. "Colliery tram wheels, &c." R. Dallimore. November 29th.
32,577. "Supply of power to electric furnaces." W. E. Burnand. November 29th.
32,578. "Electric furnace arrangement." W. E. Burnand. November 29th.
32,579. "Electric furnace arrangement." W. E. Burnand. November 29th.
32,583. "Electric heater." H. Riley. November 29th.
32,595. "Rectifying devices." A. R. Angus. November 29th.
32,621. "Dynamo-electric machine." D. Suchostawer. November 29th.
32,623. "Speed regulating apparatus." Metropolitan-Vickers Electrical Co., Ltd. November 29th. (United States, December 7th, 1921.)
32,627. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). November 29th.
32,628. "Electric heating devices." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 29th.
32,633. "Repeating systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 29th.
32,634. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 29th.
32,642. "Illuminated signs." W. J. Beville. November 29th.
32,672. "Primary batteries." R. A. Hardway and C. E. Waller. November 29th.
32,676. "Switching of circuits for charging accumulators of wireless reception sets." C. Pressland. November 30th.
32,693. "Electric switches." H. E. Sheldon. November 30th.
32,694. "Fittings for electric wiring." R. B. Matthews. November 30th.
32,703. "Colliery tram." D. J. Belben. November 30th.
32,720. "Lamps for automobiles, &c." W. A. H. White. November 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

13,182. "Generation and modulation of continuous waves for wireless telegraphy and telephony." A. Blondel and M. Touly. May 9th, 1921. (188,678.)
13,336. "Sparking plug, having a packing in its upper part subjected to pressure from below." R. Bosch Akt. Ges. June 17th, 1920. (165,080.)
13,665. "Magnetic clutches, and the like." J. W. Hall. May 13th, 1921. (Cognate application 1,756/22.) (188,682.)
13,794. "Magnetic material." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 17th, 1921. (188,688.)
13,831. "Automatic exchange telephone system." H. Baron (F. Aldendorff). May 17th, 1921. (188,689.)
13,961. "Method of electrically butt-welding, apparatus for and tubing produced thereby." A. E. White (Elyria Iron and Steel Co.). May 18th, 1921. (188,690.)
14,163. "Means for regulating the speed of electrical machines." Ges. für Drahtlose Telegraphie and W. Schaffer. August 9th, 1920. (167,744.)
16,156. "Artificial cables for duplex telegraphy." F. E. Pernot and Eastern Telegraph Co., Ltd. June 11th, 1921. (188,697.)
16,363. "Electric telegraphy." F. E. Pernot. June 14th, 1921. (188,701.)
16,809. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). June 18th, 1921. (188,707.)
18,661. "Electrical transmission or reproduction of sound." S. G. Brown. July 9th, 1921. (188,709.)
18,868. "Electrical heating devices." P. Grant (R. F. Zimmermann). July 12th, 1921. (188,714.)
19,041. "Circuit arrangements for automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. July 14th, 1921. (188,718.)
21,040. "Regulation of asynchronous dynamo-electric machines." Siemens-Schuckertwerke Ges. August 7th, 1920. (167,505.)
21,346. "Mine-rescue and like telephone apparatus." R. L. Murray and Telephone Manufacturing Co., Ltd. August 11th, 1921. (188,744.)
21,595. "Shade carriers for electric lamp holders." S. Coxon and F. M. Soulsby. August 15th, 1921. (188,757.)
21,705. "Sound transmitters and reproducers." L. De Forest. August 16th, 1921. (188,763.)
21,742. "Means for use in connecting electric conductors to railway and like rails." British Power Railway Signal Co., Ltd., and H. E. Cox. August 16th, 1921. (188,768.)
21,755. "Magnetic detents for revolution counters." Evershed & Vignoles, Ltd., and J. C. Needham. August 16th, 1921. (188,769.)
21,761. "Means for increasing sound transmitted by telephone and the like instruments." W. H. Higgs. August 16th, 1921. (188,771.)
21,814. "Apparatus for testing magnetos, sparking-plugs, and the like." E. J. Davis. August 17th, 1921. (188,775.)
21,858. "Sparking plug." F. Scott. August 17th, 1921. (188,781.)
21,954. "Construction of winding for dynamo-electric machines." W. E. M. Ayres. August 18th, 1921. (188,789.)
21,986. "Method and means for dimming the electric lamps of automobiles." G. E. Webb. August 19th, 1921. (188,792.)
22,051. "Apparatus for projecting light and other electro-magnetic radiation." O. H. Pieper and A. F. Pieper. September 15th, 1920. (169,150.)
22,084. "Automatic excitation regulator for dynamo-electric machines." J. T. Irwin and A. Rushton. August 20th, 1921. (188,795.)
22,148. "Electric meters." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. August 20th, 1921. (188,797.)
22,583. "Magnetic separators." J. S. Atkinson and Powdered Fuel Plant Co., Ltd. August 25th, 1921. (188,814.)
22,666. "Self-induction coil pair for loading telephone lines." Felten and Guilleaume Carlswerk Akt. Ges. January 17th, 1921. (174,320.)
22,614. "Apparatus for transforming the crystal structure of wires, filaments, and the like." General Electric Co., Ltd. (Patent-Truhand Ges. für Electrische Gluhlampen). August 25th, 1921. (188,815.)
22,716. "Cooling and ventilating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. August 26th, 1921. (188,819.)
22,756. "Switch fuses." C. W. McDowall and Norwest Electrical Manufacturing Co., Ltd. August 27th, 1921. (188,820.)
23,020. "Holders for thermionic valves." General Electric Co., Ltd., and C. G. Eden. August 30th, 1921. (188,823.)
23,149. "Electrodes for electric welding cutting and the like." W. H. Flood, D. T. Smout and A. C. Cutting & Welding Co., Ltd. August 31st, 1921. (188,824.)
23,253. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 1st, 1921. (188,827.)
23,954. "Electro-magnetic regulating or controlling devices for dynamo-electric machines." Vickers, Ltd., and J. Etchells. September 8th, 1921. (188,834.)
24,761. "Electric lead terminals and the manufacture of the same." W. Preston and W. Horton. September 19th, 1921. (Cognate application 16,839/22.) (188,843.)
26,168. "Sparking plugs of internal-combustion engines." W. H. Shute. October 26th, 1921.) (188,874.)
26,409. "Universally-adjustable electric lamp support." F. Chabloz. October 6th, 1921. (188,880.)
26,530. "Electro-magnetic brakes." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 7th, 1921. (188,881.)
26,746. "Electric ignition apparatus." E. H. Cardwell. October 10th, 1921. (188,884.)
27,045. "Supports for electrical busbars." A. H. Railing, C. C. Garrard, P. H. Coales and S. Darby. October 12th, 1921. (188,891.)
27,110. "Electric switches." British Lighting and Ignition Co., Ltd., E. O. Turner and E. B. Tuppen. October 12th, 1921. (188,893.)
27,230. "Brush holders for dynamo-electric machines." A. H. Railing, R. Orsettich and A. E. Angold. October 14th, 1921. (188,895.)
27,404. "Safety appliances for use in connection with passenger lifts or other lifts or elevators, hoisting machinery, and the like." P. H. A. Dore. October 15th, 1921. (188,897.)
27,435. "Relay circuit arrangements for use more particularly in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. November 17th, 1920. (Addition to 123,035.) (171,678.)
28,063. "Electric fly and insect killer." H. A. Thomas. October 22nd, 1921. (188,907.)
28,389. "Electric light ceiling fixtures." T. S. Turnbull. October 26th, 1921. (188,918.)
28,492. "Spark plugs." P. V. Carpenter. October 26th, 1921. (188,919.)
28,721. "Method of assembling and protecting the electric wires for connecting the commutator and ignition coils such as are used on internal-combustion engines of the Ford and like types." H. G. Southard and V. W. Meager. October 29th, 1921. (188,924.)
29,581. "Lightning or surge arresters for electric conductors." A. Reyrolle and Co., Ltd., and W. D. Owen. November 7th, 1921. (188,939.)
30,096. "Telephone instruments." J. E. Pollak (Siemens & Halske Akt. Ges.) November 10th, 1921. (188,943.)
30,227. "Telephone receiver." Western Electric Co., Ltd. December 2nd, 1920. (172,291.)
31,037. "Electrodes or anodes employed in systems for the prevention of corrosion and scale formation in steam boilers, condensers, and other liquid containers." V. H. Cruikshank. November 21st, 1921. (188,957.)
31,894. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. December 7th, 1920. (172,623.)
32,059. "Instrument for the therapeutic treatment of the throat with rays from an arc." W. G. Moore. November 30th, 1921. (188,970.)